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COMPUTER & VIDEO GAMES

No 6 APRIL 1982

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NEXT MONTH

OUTWIT unknown human opponents in a fantasy world adjudicated by computer. Games moderated by computer are ripe for take-off in the U.K. In May we will give you a rundown on the no-holds-barred computer moderated games scene where you have to stay on the alert even when you're not playing!

WITH Packman games cropping up everywhere, we felt it was time we featured one ourselves. Meteor Storm, Earth Port II, Spiderman and Anti-Gravity Flyer also feature in an issue packed with the best games.

JUST how far can you expand a Sinclair's memory? Who produces the top games software for it? What peripherals are available? Our May Hardcore section is given over to the possibilities of this unique machine.

Editor Terry Pratt
Assistant editor Elspeth Joiner
Editorial assistant Susan Cameron
Design Linda Freeman
Production editor Tim Metcalfe
Advertisement executives Rita Lewis, Neil Wood
Advertisement assistant Louise Flockhart
Publisher Tom Moloney

Editorial and advertisement offices: Durrant House, 8 Herbal Hill, London EC1R 5JB; Telephone Editorial 01-278 6556, Advertising 01-278 6552

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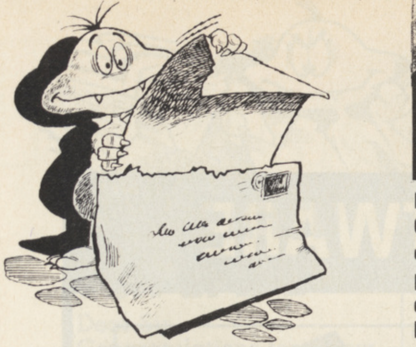

MAILBAG

Do you have any views or comments on Computer & Video Games? If so we would love to hear from you. We will also do our best to find answers to any queries you may have or solve problems you might be experiencing with your computer. Please drop us a line at: Computer & Video Games, EMAP, Durrant House, 8 Herbal Hill, London EC1R 5JB.

VIVE LE SINCLAIR

Dear Mr Editing-Person,
I'll start by saying what a fab piece of material your mag is. Well thought-out, interesting, colourful, witty in places and highly entertaining to the last computer-packed page. Absolutely wizard and all that.

But may I outline one slight fault ... so far you have only published small, rather feeble 1K Sinclair ZX81 games. I know the ZX81 cannot be described as the greatest personal computer but give it some credit, please.

If it's not too much for your megabytic brain to manage, could you print an exciting, highly interesting and graphically stunning 16K Sinclair game which will be a credit to all ZX81 owners and will prove to other more advanced computer owners that it's more than a child's toy.

Everyone knocks the ZX81 but I think other computer manufacturers should follow Sinclair's example and produce a basic, low-cost and compact machine which can be expanded to be more powerful through the addition of plug-ons, like memories, keyboards, sound systems etc.

Peter Townend
Walmer,
Kent.

CLUBBING TOGETHER

Dear Sir,
We would be most obliged if you will let your readers know that a computer club has been started in the Hartlepool area, via your Mailbag pages.

The first meeting of the club was held at The Welfare Hall for the Blind, Avenue Road, Hartlepool on Friday, February 26.

Mr Harry Cuthbert is the acting chairman and Mr David Jones the acting sec, both can be contacted most evenings after 6.30pm on Hartlepool 71027 or 66001.

It is hoped that anyone who has an interest in computing will join the club, non-owners are also most welcome.

David R. V. Jones,
Hartlepool,
Cleveland.

IN BLACK AND WHITE

Dear Sir,
I would be grateful if you could help me with some information. All the computer chess games advertised seem to work on boards and pieces are supplied.

Have you any knowledge of a straightforward chess computer i.e. to cater for the persons like myself who already own a chess board and pieces.

Ronald Whiteside,
Lisnasharragh,
Belfast

Editor's reply: The only computerised chess game on the market which you can use your own chess board and pieces with is made by Ace of Wembley. The actual computer looks very like a pocket calculator and the moves made are displayed on a small L.C.D. screen. You just position your pieces accordingly. It's official name is Acetronic Electronic Chess and costs £24.95 from Ace distributors. For a full list of dealers contact Ace at 3 Fulton Road, Wembley Park, Middlesex.

GETTING IT TAPED

Dear Sir,
I want to use a Sinclair pre-recorded tape on my Sharp MZ-80K computer. As the Sinclair ZX81's are simple machines I thought it would accept it, but it wouldn't load.

Could you tell me if it is possible to load these cassettes on to my machine and what I should do to make it work?

I look forward to the next issue of your magazine and hope you don't forget the Sharp MZ-80K.

P. Alsen,
Stockton Lane,
York

Editor's reply: First the good news Mr Alsen, we will continue to feature the Sharp MZ-80K in the magazine. Now the bad news. You can only use cassettes which contain programs specially written for the Sharp with an MZ-80K. There is no way to convert your Sinclair tape to load, so I'm afraid you will have to either buy a Sharp games tape from a supplier or have a go at writing your own games.

CHEAP AND CHEERFUL

Dear Sir,
I am in the process of purchasing a Sinclair ZX81 and would like to know whether or not a cheaper 16K RAM is available for it other than the Sinclair one?

I would also like to know if 16K is the limit of the ZX81's memory? If not, I'd like some details please.

I own a JVC T.V. cassette radio set and could you tell me if I can use it in conjunction with the ZX81 for the T.V. and cassette facilities? I would also like to know if the ZX81 can have sound facilities.

V. Buchanan
Dollar,
Scotland.

Editor's reply: There are a couple of firms who supply 16K RAM packs for the Sinclair ZX81 which cost less than Sinclair's own version. These are: Audio Computers of Southend-on-Sea which costs £33. Byg Byte of Petersfield, Hampshire which sells one for £42.95.

Expansion boards are available for the ZX81 right up to 128K. Audio Computers is the firm selling that, and smaller memory boards: 32K, £45; 64K, £73; 128K, £123.

I'm afraid that your JVC is not one of the cassette recorders Sinclair Research recommends. I suggest you write to Sinclair and they will give you a full list of ZX81 compatible cassette recorders.

Alternatively, you could wait until we publish our next issue (May) when we will be featuring the ZX81 in our Hardcore pages giving details of peripherals available.

ZX 80/81 HARDWARE/SOFTWARE

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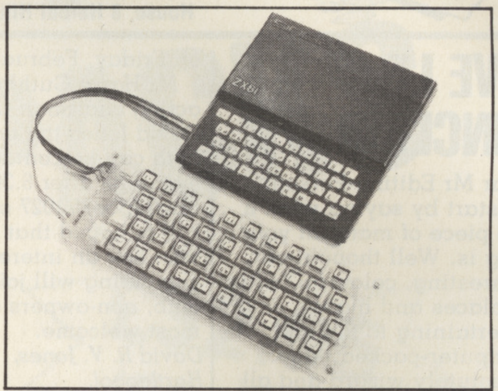

4K GRAPHICS ROM

The dK Graphic module is our latest ZX81 accessory. This module, unlike most other accessories fits neatly inside your computer under the keyboard. The module comes ready built, fully tested and complete with a 4K graphic ROM. This will give you 448 extra pre-programmed graphics, your normal graphic set contains 64. This means that you now have 512 graphics and with there inverse 1024. This now turns the 81 into a very powerful computer, with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders graphics and that only accounts for about 50 of them, there are still about 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there; it also has a spare holder on the board which will accept a further 4K of ROM/RAM. IT NEEDS NO EXTRA POWER AND WORKS FROM YOUR NORMAL POWER SUPPLY. **£27.95**

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16K KIT-A-KIT VERSION
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16K 81 SOFTWARE

As seen at the ZX Microfair.
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3D/3D LABYRINTH You have all seen 3D Labyrinth games, but this goes one stage beyond; you must manoeuvre within a cubic maze and contend with corridors which may go left/right/up/down. Full size 3D graphical representation. £3.95.
CENTIPEDE. This is the first implementation of the popular arcade game on any micro anywhere. Never mind your invaders, etc., this is positively shining, the speed at which this runs makes ZX invaders look like a game of simple snap. £4.95.
Please add £1 p&p for all hardware, Software p&p free. Specify ZX80/81 on order.
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MAILBAG

THE SEARCH FOR SPEED

Dear Sir,
Congratulations for a new, excellent and very different magazine. The series on writing Adventure type games is superb and Round the Horn was the best program I've ever seen published for TRS-80.

I know you're more of a software magazine, but as yours is the only mag I buy regularly (grovel, grovel) I would like to ask a hardware question; I know the clock in the TRS-80 can be speeded up, but I'm not sure how and what components have to be bought. Could you tell me how or suggest where a kit can be bought? I want it switchable between old and new speeds for purpose of tape transfer. My set-up is TRS-80 Model 1 Level 11 16K with cassette and Aculab.
C. Bennett
Bamkin-of-Craigs,
Dumfries.

Editor's reply: According to Martin Soble of Tandy Corporation's merchandising department, it is possible to increase the speed of the microprocessor in your computer itself but he does not recommend doing so. He told Computer and Video Games that a couple of small dealers sell kits to carry this out, but he likened it to doing a "hot rod" conversion on a car. It goes faster but wears it out more quickly.

So if you want your TRS-80 to last, take Martin Soble's advice, you will be better off in the long run.

NIBBLERS NIGGLE . . .

Dear Sir,
Having tried out the Nibblers program in the first edition of *Computer and Video Games*, I found that I could not fire missiles or drop bombs on the Nibblers. I am new to computers and so would not know where to start looking for the fault. My friend's father, who deals in computers, was also puzzled by this. I would be very pleased if you could assist me to solve the problem.
E. Bryant,
Haxby,
York.

Paul Jay replies: There is, in fact, no fault in the Nibblers program. The trouble is that you have got an old PET.

Many of the memory locations have been changed since the original machine came out. The location that has been changed in this particular program is 151. When the machine looks at this part of memory, it can tell if a key is being pressed down. All you have to do to make the game work is to change the 151 which appears twice, to a 515. This will also be necessary if you want other PET programs to run on old machines. For example Dragon Druggin'.

THE RIGHT CONNECTIONS

Dear Sir,
I have recently acquired a VIC-20 and after hearing from a friend about a connection to fit a normal tape recorder to it. I decided not to buy the £40 plus, special tape recorder. I asked in the shop my friend told me about and they said they were expecting some in soon. Impatiently I asked at another shop and they didn't know anything about it. Is the connection made by Commodore or by another firm?
Nadeem Farugue
Newton-with-Scales,
Lancashire.

Editor's reply: A firm called Stack of Liverpool is in the process of bringing out an adaptor designed to link up a normal cassette recorder with the VIC-20, but has not yet brought it out.

But according to one of Commodore Business Machine's technical experts the adaptor, which is expected to cost between £5 and £10, is only worthwhile if you have relatively small amounts of data to store if you can't afford the price of a Commodore recorder.

Commodore's expert did say that the quality of material stored using this adaptor would not be as good as a Commodore compatible because normal recorders record audio signals rather than NRZI signals — the method used to record computer signals.

Commodore itself does not make an adaptor to convert a normal recorder for use with the VIC-20.

SYSTEMS ANALYSIS

Dear Sir,
As the proud owner of a ZX81, I would greatly like to expand it in all directions. However, the proliferation of add-ons, software and books too numerous to mention have reduced me to gibbering lunacy!

I would like to know how far it is possible to enlarge the system capacity and capability. If the ZX81 possibilities are limited — without major surgery! — then I would seriously have to consider another system. I was horrified to see no less than 49 Sinclair ZX80/81's for sale on the transaction page of another magazine. Could it be that other ZX owners are losing heart? Help!!!

Who makes the 64K RAM slot-in mentioned in your January issue?
Chris Wilkes
Harefield,
Middlesex.

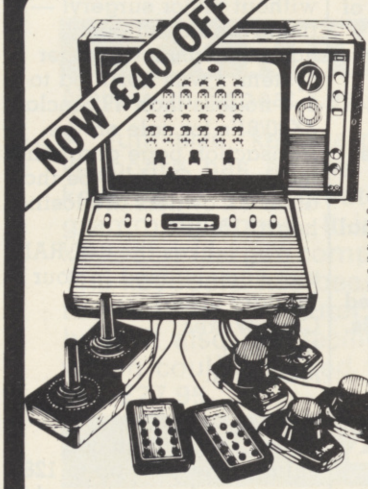
Editor's reply: You can enlarge the ZX81 up to 128K memory using a range of expansion boards. Audio Computers is the firm to contact at 87 Bournemouth Park Road, Southend-on-Sea.

Here is a list of prices:

16K	**£33**
32K	**£45**
64K	**£73**
128K	**£123**

Audio Computers will be happy to give you further details of goods available for the ZX81 if you get in touch with them.

SALE ELECTRONIC GAMES



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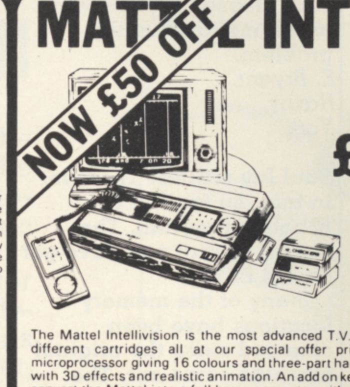

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MATTEL OWNERS CLUB — Why not join our Mattel Owners Club and recive our regular newsletters containing details of all the latest cartridge releases. Telephone us with your name and addresses and we will add your name to our computer mailing list.

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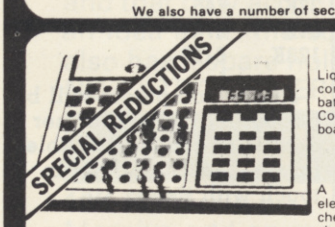

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Pac Man 2 is based on the latest pub game. It is a two-colour game of strategy, tactical pursuit and destruction pitting Pac Man against the large Ghosts. The object of the game is for Pac Man to attain as high a score as possible by capturing and destroying Ghosts, Bugs and Energizers without being himself destroyed by the Ghosts. Pac Man 2 incorporates the most modern and complex status displays ever produced and is now on release for the first in the UK offering an ideal present.

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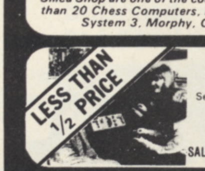

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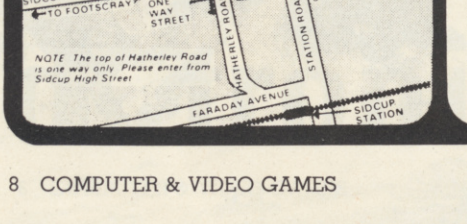

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SILICA SHOP

THE PICK OF OUR PUZZLERS

The octagon puzzle which featured on the cover of our first issue, certainly set your grey-matter alight.

Over 700 entries of programs to solve the puzzle by computer, deluged our office and caught us quite unawares.

Whittling down all the entries was a long and difficult task for our judges but they have finally come up with the three best entries.

To give everybody a fair chance we laid down a set of criteria for the judges to use as a guideline in making their comments. Entrants could score a possible total of 45 points for the programs submitted, but no-one managed a 100% score.

The most important aspects of the judging were on the standard of programming. Exactly how concise the programming was and whether it contained unnecessary frills into the entry.

Another important factor in judging was the speed each program took to find the solution. Highest marks went to those whose programs found the solution quickest. Further points were awarded if it proved there was only one solution.

The three to emerge as winners are Gorden Bennett of Hampshire, Adrian Womack of Doncaster, and Christopher Holt of Gravesend.

Gordon achieved the highest score of 43, Adrian got a close 41 and several reached the 40 mark. Our judges finally selected Christopher Holt's entry as the third winner because it was the best presented of the three tying programs.

Congratulations to the three final winners and our commiserations go to the other unlucky hundreds who entered.

The winning program by Gordon was written for a Microtan 65 computer and earned high points because of its simplicity of execution and accuracy in programming. With his program listing he submitted documentation but none of it was in-depth details about converting symbols to numbers or letters. You also didn't have to sit and wait for a long time for the program to do something, which was a common complaint.

Another interesting feature of this program was that instructions were explained in the program itself, making it easy to use. The solution was found in one minute 44 seconds.

The other two winning programs were of an equally good standard of programming finding the solutions quickly. But they fell down on other points, particularly presentation. They were written for a Sinclair ZX81 and an Acorn Atom.

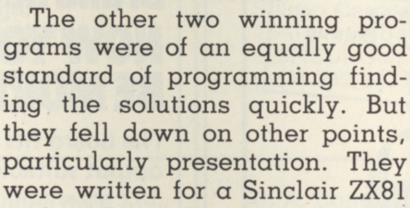
Three VIC computers will be winging their way towards the winners as soon as possible. We wish the winners hours of happy programming and also offer our thanks to the many judges for their time and effort.

BRAINWARE ANSWERS

The answer to our March Mind Routines problem is that there are 34 prime numbers. The highest is 95731 and the lowest is 13497. The total of the 34 prime numbers is 1842502.

The correct solution to last month's Nevera Crossword is printed right and the winners' names will be published in next month's issue.

For more puzzles to tax your mind turn to page 83 where you will find this month's problems.



1 D	U	A	2 L	D	I	3 S	K	4 D	R	5 I	V	E
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6 S	H	I	F	T	■	T	■	O	■	P	■	■
C	■	■	T	■	7 S	U	R	R	O	U	N	8 D
9 R	U	G	B	Y	■	P	■	S	■	T	■	E
A	■	■	A	■	■	O	■	■	10 S	■	■	F
11 B	L	A	C	K	A	N	D	W	H	I	T	E
B	■	■	K	■	■	■	■	■	O	■	■	N
L	■	12 E	■	13 A	■	14 S	■	15 S	W	O	R	D
16 E	N	V	E	L	O	P	E	■	D	■	■	E
■	■	E	■	T	■	O	■	17 C	O	V	E	R
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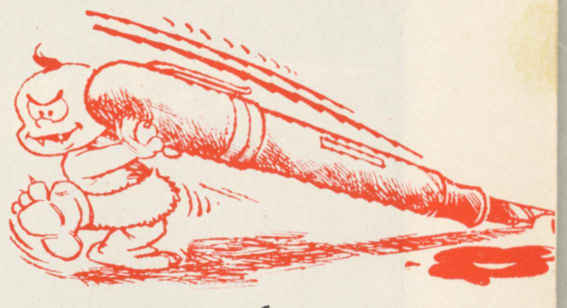


Confessions of a Bug

Just in case any of you out there weren't appreciating the work which we Bugs are putting in behind the scenes here, I've persuaded the editor to give me my own column to explain.

Changing Hearts **in the March issue was one of our biggest successes — made all the more so by the fact that many readers managed to enter it first time.**

The listing itself was error-free but two all-important commas went missing from the accompanying write-up. Line 40 in the write up should read: G$ = "ABDE,ABC,,BCEF, ADG,,BDEFHCFI,,DEGH,GHI,,EFHI,"

Alien Hunt **in the February issue also caused some problems for readers whose Acorn Atom did not have sufficient of the necessary memory to run it. Unfortunately author John Kirk was all too quick to their rescue, suggesting that they remove instructions subroutine in line 1 and lines 32000 to 32111.**

T. Hitch was put to work at the printers to give ***Dogfight*** **fans a little extra workout on the Apple in the February issue. He transposed lines 1160 to 1190 out of position, which itself would have been easily righted, but then he cunningly continued with:**

```
ITS";M(2);"MISSILES"
```

which belongs to line 1309.

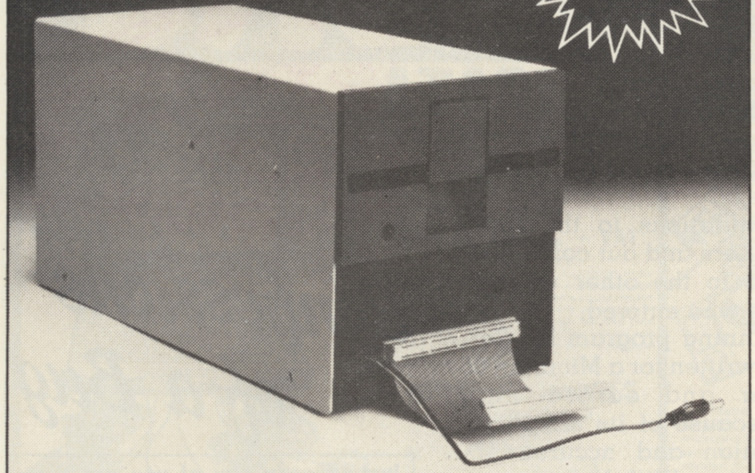
Screaming Foul-up did the printing run for the March issue and pulled seven lines out of the ***Air Attack*** **listing. The missing lines are:**

```
2050 LP=0:K=0:GOTO 100
2100 FOR ZQ=1 TO 21
2105 ZX=ZQ*41+X+1: POKE ZX, 28
2110 BN=PEEK (ZX+41): IFBN = 32
     THEN 2120
2115 GOTO 2200
2120 POKE ZX, 32: NEXT ZQ
2130 GOTO 100
```

yours
Mal

it's here at last!

NEW



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You will need an Atom with bus buffers and indirect edge connectors. The mail order price is £350 including VAT post, packing and insurance, the price at your Atom dealer £345.

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ACORN COMPUTER
Acorn Computers Ltd.,
Fulbourne Road,
Cherry Hinton, CAMBRIDGE

The disk operating system (DOS) decodes the following commands used to control the storage of files on disk:–

Command	Description
* CAT	catalogue files on disk
* LOAD	load image of memory contents as file
* SAVE	save image of memory contents as file
* DELETE	delete file from disk
* SPOOL	store all printer characters on disk
* EXEC	read characters from disk as if from keyboard

The DOS also replaces the cassette operating system vectors as used by BASIC to allow the use of the following commands in Atom BASIC:–

Command	Description
LOAD	load BASIC program from disk
SAVE	save BASIC program to disk
FOUT	open file for output
FIN	open file for input
SHUT	close file
EXT	find extent of file
PRT	find value of pointer into file
PUT	put number to file
BPUT	put byte to file
SPUT	put string to file
GET	get number from file
BGET	get byte from file
SGET	get string from file

These commands provide full random access of up to 5 disk files simultaneously.

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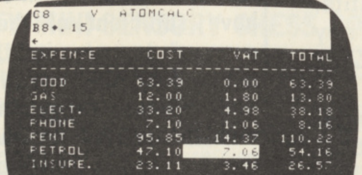

```
C8      V   ATOMCALC
B8*.15
←
EXPENSE       COST       VAT      TOTAL
---------------------------------------
FOOD         63.39      0.00      63.39
GAS          12.00      1.80      13.80
ELECT.       33.20      4.98      38.18
PHONE         7.10      1.06       8.16
RENT         95.85     14.37     110.22
PETROL       47.10      7.06      54.16
INSURE.      23.11      3.46      26.57
---------------------------------------
EXPENSES                         314.50
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```

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The ROM creates an enormous grid of columns and rows like a ledger. All you do is to enter the headings and formula once and Atomcalc does the rest. Supplied with a very detailed 30pp user handbook.

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Atomcalc can cope with anything from a household budget to company accounts. You set up a series of automatic calculating functions like totalling or percentages. Then fill in the columns with your figures and the program produces the answers. If you want to change one figure in the calculation it immediately changes the relationship of all the other figures involved. So, for example, you can see what effect on profit a 5% increase in sales might have or a 10% increase in production, or a 3% drop in transport.

And do not forget you can print them out on an optional printer or store them on tape.

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Go to your Atom Dealer, or if there are none in your area just send a cheque for £39.10(incl. VAT and P & P) to the address below. Credit Card holders can ring Cambridge (0223) 316039 and order direct.

Dept. 6 Acornsoft Ltd, 4a Market Hill, CAMBRIDGE.

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– A PAL encoded signal on Channel 36 suitable for feeding into the aerial socket on a domestic television.

You can fit the board yourself using a fine soldering iron or your dealer will fit it for you. The board can be used in a minimum Atom with the exisiting power supply, or if used in a maximum Atom a 5V exernally regulated supply will be necessary.

Available from all Acorn Dealers or direct from Acorn at £45.24 inc VAT and p+p. Credit card holders can ring (0223) 245200 and place their orders direct.

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Cherry Hinton, Cambridge

ACORN COMPUTER

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- INKEY $X – scans keyboard-input to string variable
- IF . . . THEN . . . ELSE
- WHILE . . . ENDWHILE
- CURSOR X,Y – position cursor as required
- ON ERROR
- BEEP X,Y – sound a note-any duration, any pitch
- ZERO – zeroes all basic variables
- POP – close out sub-routine
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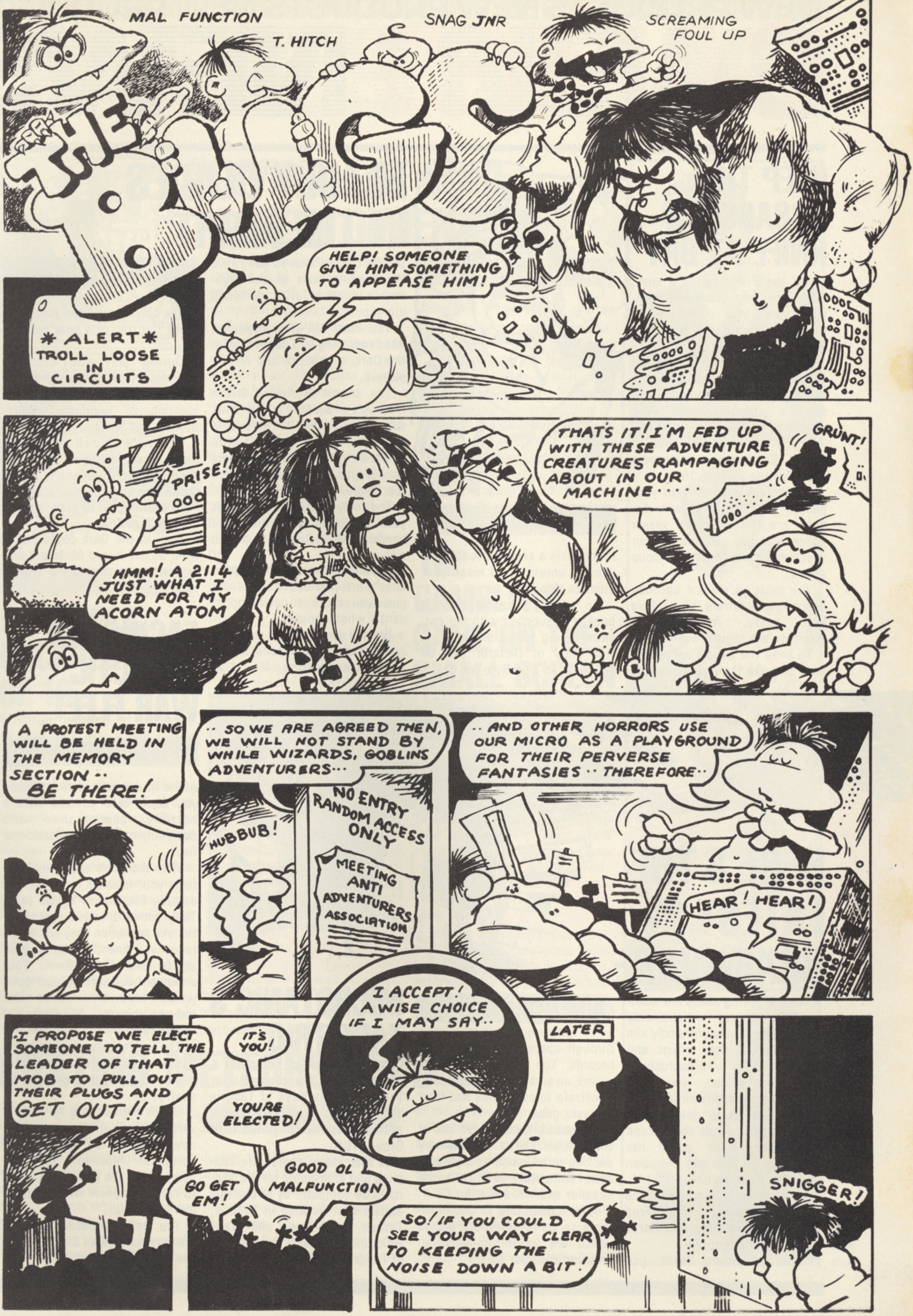
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THE
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PRISE!
HMM! A 2114 JUST WHAT I NEED FOR MY ACORN ATOM
THAT'S IT! I'M FED UP WITH THESE ADVENTURE CREATURES RAMPAGING ABOUT IN OUR MACHINE.....
GRUNT!
A PROTEST MEETING WILL BE HELD IN THE MEMORY SECTION.. BE THERE!
.. SO WE ARE AGREED THEN, WE WILL NOT STAND BY WHILE WIZARDS, GOBLINS ADVENTURERS...
HUBBUB!
NO ENTRY RANDOM ACCESS ONLY
MEETING ANTI ADVENTURERS ASSOCIATION
.. AND OTHER HORRORS USE OUR MICRO AS A PLAYGROUND FOR THEIR PERVERSE FANTASIES .. THEREFORE..
HEAR! HEAR!
.I PROPOSE WE ELECT SOMEONE TO TELL THE LEADER OF THAT MOB TO PULL OUT THEIR PLUGS AND GET OUT!!
IT'S YOU!
YOU'RE ELECTED!
GO GET EM!
GOOD OL MALFUNCTION
I ACCEPT! A WISE CHOICE IF I MAY SAY..
LATER
SO! IF YOU COULD SEE YOUR WAY CLEAR TO KEEPING THE NOISE DOWN A BIT!
SNIGGER!

GAMES NEWS

KEEP THE ASSASSIN'S KNIFE AT BAY

DICTATOR

Being the President of a small state can cause you a few problems. Often your country is on the brink of civil war or revolution.

But as the head of the state your job is to ensure the smooth running of political life and aim to achieve prosperity for your people.

That's just what you have to do in Dictator, an adventure game for the ZX81 in 16K.

The object is to prevent your people revolting. At your disposal are the army and secret police who you can use to your advantage if the threat of a coup arises.

You must be vigilant because spies may infiltrate your close knit party. Assassination attempts are regular events.

To keep the people happy you have to make the right decisions to maintain a secure economy. If you fail unrest could mean your ultimate downfall.

An eight page instruction booklet is supplied with the cassette giving full information.

A copy of Dictator can be bought from Bug-Byte for £9.

DEADLY BLADES IN THE NIGHT

DUEL IN THE DARK

Deadly blades flash as you relive the duelling days of the eighteenth century in a darkened dungeon.

You must kill your opponent after searching him out in Duel in the Dark, a game for one or two players.

The screen is divided into a rectangle of squares which forms your battleground. It represents a dungeon which has two windows. But you can't see anything because it's dark outside — none too helpful.

The only good thing is that your opponent faces the same handicap — he can't see you either.

Objects litter the dungeon which are hazardous but also give you clues to your opponent's whereabouts.

Both of you are given a dagger and a knife as weapons in the two player version. If it's in single player mode the computer takes the role of a bear seeking you out.

During play you discover information about the dungeon's layout — making notes of the location of windows, doors, objects and walls.

When the crunch comes you have three methods of doing away with your opponent. Either throw the knife at him, stab him with your dagger or grab him and grapple him down.

Duel in the Dark costs £10.93 from Bexhill based Molimerx and is designed to run on a TRS-80 level II.

FACING THE GALACTIC WAR FLEET

SPACE FIGHTER

Alone in deepest, darkest space you come face to face with a horribly beweaponed and decidedly unfriendly galactic war fleet.

With the stars your only company your mission is to find and destroy five enemy fighter craft. They patrol different sectors of the sky and when they are within range you line them up in your sights and blast them. Your armament consists of laser guns which instantly reduce the enemy ship to fragments of space dust.

The fighters are equipped with missiles and can return rapid fire at your ship so you have to avoid destruction.

Space Fighter is a re-vamped version of the original game and now runs on a TRS-80 Colour Computer. Molimerx, the supplier, claims the game lends itself to colour graphics which make it more realistic.

You need joysticks and 16K memory as well as £10.06 to get the game up and running.

HERE'S THE LATEST IN BRAINWARE

ADVENTURE C

A band of roving aliens are scanning the universe for humanoids with the decidedly unfriendly aim of taking out their brains and replacing them with microchips. What do you mean you know someone they found already!?

Your task is to defend your ship from the aliens and escape the gravity beam which has sucked your ship into the alien cruiser's flight path.

It is during a reconnaissance mission that your android Fred spots the alien ship and warns you of their intentions.

Your adventure leads you through space into all sorts of hazards. You explore computer rooms, an android pleasure room, penetrate force shields and fend off laser guns.

Adventure C makes full use of the Sinclair ZX81's 16K memory packing in as much as possible. Artic Computing in Hull is the supplier and will sell it for £9.

Artic Computing is establishing a series of adventure games which are written in-house in machine code for speed.

MICROTANIC'S TAPE TRIO

In the last issue of Computer & Video Games, the cassettes for Tank Raid, Six Keys of Tangrin and Tanlan Adventure were attributed to the Tangerine User Group (TUG).

In fact, these games are supplied and distributed for the Microtan 65 computer by Microtanic Software of Dulwich in London. Tanlan Adventure and Tank Raid run in 16K and The Six Keys of Tangrin in 8K.

GAMES NEWS

GIVING THE CUBE A NEW DIMENSION

RUBIK'S CUBE

That most frustrating of puzzles Rubik's Cube is maintaining its popularity with the arrival of two computerised solutions.

A game to help you solve your cube on your screen without any of the thumb twiddling is now available for the Texas Instruments 99/4A computer.

Sticking to the original concept dreamed up by Rubik the game allows the player to simulate every possible rotation in order to solve the Cube. If you find it all too mind-blowing you can always save it on tape and pick up where you left off later after giving your addled brain a rest.

Another feature of the simulation enables the player to spin the cube to see the reverse sides.

But for those of you who can solve the Cube in 30 seconds flat, there's always the Quadcube.

The sinister sounding Quadcube has a four-by-four grid so there are even more combinations to puzzle over.

To cope with the complexity the program uses special commands allowing up to 30 moves to be stored for scrambling or unscrambling whenever the user wishes.

Work Force of Luton take the blame for any extra frustration this might cause you. And if you part with £9 you can take on the Quadcube.

CASSETTE TWO

A BUMPER PACKAGE OF 10

A bumper package of games to jolt your brain into action comes in the shape of this tape for the ZX81.

There are 10 games; Othello, Awari, Laser Bases, Word Mastermind, Rectangles, Crash, Roulette, Pontoon, Penny Shoot and Gun Command.

Each of the games on the tape is explained in the accompanying leaflet plus loading instructions. You'll need a 16K machine to run the games tape which is simply called Cassette Two.

It's the second cartridge in this range produced by Michael Orwin of Willesden, London, and sells for £5. Copies can be obtained from him by mail order.

THE GAMBLERS' GAME ON THE SMALL SCREEN

BACKGAMMON

The joys and frustrations of Backgammon come to the small screen with this computerised version.

The game, beloved by the gambling fraternity, is well suited to computerisation and makes a capable opponent.

There are six strategies to choose from and the computer soon latches on to your attempts to defeat it.

The makers, Futura Software, claim the game has a fast response time as well as a high standard of play. When you make a move the computer brain automatically checks if it is valid. If it's an illegal move the computer will tell you so.

A special feature of the game is a tumbling dice effect represented by a graphics demonstration. A full instruction sheet and rules of Backgammon come with the program, which is written for the Nascom and costs £6.95 from Future Software of Chelmsford.

For the uninitiated, Backgammon is a simple race game, with two players trying to be first to move into the home section and off the board. But counters left alone can be returned to the start by an alert opponent.

MEETING METEORS HEAD-ON

COSMIC ZAP

Cosmic Zap is one of the latest in a batch of Sharpsoft games for the Sharp MZ80-K computer.

You are fighting against time — 10 minutes to be precise — and your job is to survive an asteroid storm while destroying aliens at the same time.

Points are scored for each object you destroy and there is a facility for the five top scorers to be put into the memory.

The asteroids can be deceivingly menacing. Without warning the aliens you think you are ramming, fly into your flight path and on face transforms into one of the deadly asteroids.

Another feature of the game is the mother ship, which makes an appearance after 10 minutes of the game. The mother ship could be your saviour because it has a device which your ship can use for docking purposes.

Cosmic Zap is on sale from London based Sharpsoft for £5.85.

THE VIC NEEDS VIC REVEALED

THE DEFINITIVE REFERENCE BOOK ON THE VIC SYSTEM FROM NICK HAMPSHIRE

Now available. Price £10.00 from Commodore dealers and bookshops. Nick Hampshire Publications, P.O. Box 13, Lysander Road, Yeovil, Somerset.

VICMEN

GHOST OF A CHANCE

VIC software is at last filtering through to owners of the long-awaited machine and Bug Byte has leapt in quickly with some games.

Kicking off the range is Vicman, the VIC version of the popular arcade game Pacman. Bug Byte says this game is a very good copy of the original with lots of little mazemen and a "glooper" who runs around the maze devouring dots as he goes.

Fruits appear in the maze when you amass a certain number of points and large flashing dots cause the mazemen and glooper to change colour. Sometimes the mazemen are in a consumable state and it's then that they run away from the glooper . . . but be careful, they may suddenly turn tail and turn in pursuit of you.

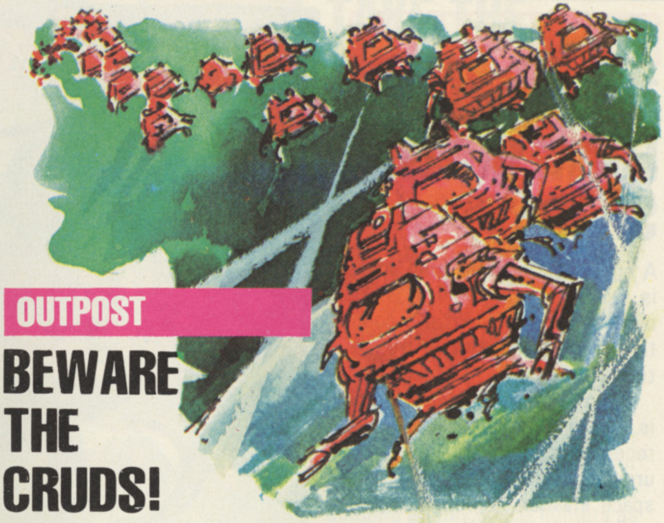
You are only given three lives so you must be careful manoeuvering your glooper along the paths of the maze. If you run into a ghost, your life is lost as he gobbles you up.

When you eat one of the ghosts a pair of flashing eyes darts back to the centre of the screen. You can use either joysticks or keyboard controls to run the game, depending on your own preference.

The screen has to be cleared of all the dots to earn a new one and a new fruit to consume.

The colourful VIC is well suited to reproducing a good replica of this absorbing and addictive game.

Vicman runs on the unexpanded VIC and costs £7 from Bug Byte of Liverpool.



OUTPOST

BEWARE THE CRUDS!

The Kamicosmic Cruds are one of the most hostile species to be found in space — like Vogons — except without any literary pretensions.

You only have two types of weapons to call on to defend yourself when you come across them in Outpost.

They are a propulsion unit and a meteor shield. Your square shaped ship has weak spots, particularly vunerable to enemy fire.

Two hits on the same side of the ship spell death. One hit prevents the propulsion unit rotating the ship to that position. If you overwork the unit it will overheat and stop working.

Outpost is difficult to operate because you have to use eight keys to control the action. But once you have mastered the technique it proves a demanding game.

It runs on an Apple II in 48K and is available from Richmond based SBD Software for £16.95.

A HARD RAIN'S GONNA FALL

MISSILE BASE

A deadly rain of missiles is falling on your cities. You must save them from destruction.

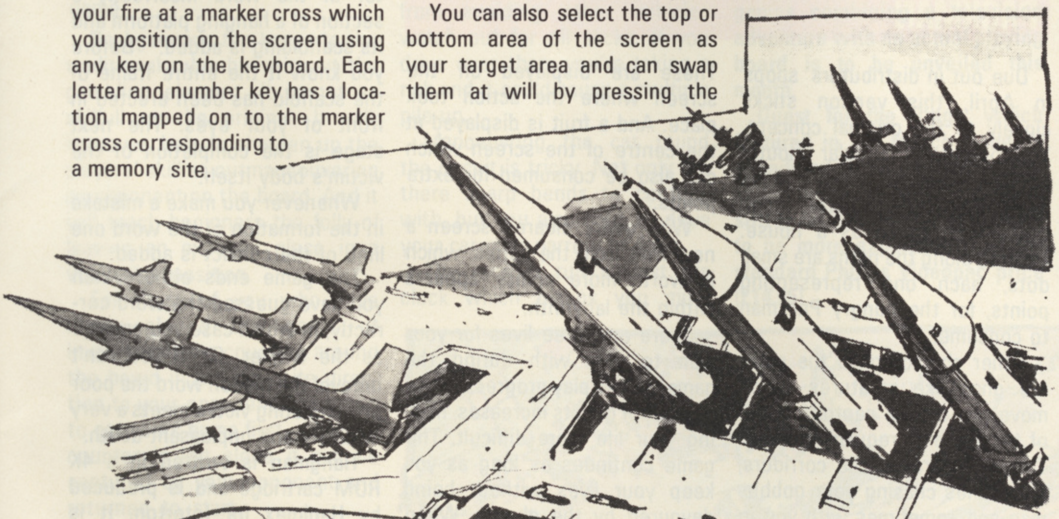
The Acorn Atom version of the popular arcade game Missile Command is included on the latest Acornsoft package.

You get three ground bases to form your defence sites. Aim your fire at a marker cross which you position on the screen using any key on the keyboard. Each letter and number key has a location mapped on to the marker cross corresponding to a memory site.

The cross will move to the appropriate spot that the depressed key represents. As you can guess it takes a while to work out and memorise exactly where the cross will land up.

You can also select the top or bottom area of the screen as your target area and can swap them at will by pressing the space bar. The enemy's fire will destroy your bases if you do not stop them in mid-flight.

Missile Base forms the major game on Games Pack 11 accompanying a version of snooker and traditional dominoes. Available from Acornsoft of Cambridge for £11.50.



AND THE WORD WAS OOPS . . .

THE BIBLE

In the beginning was the word and the word was "oops . . ."

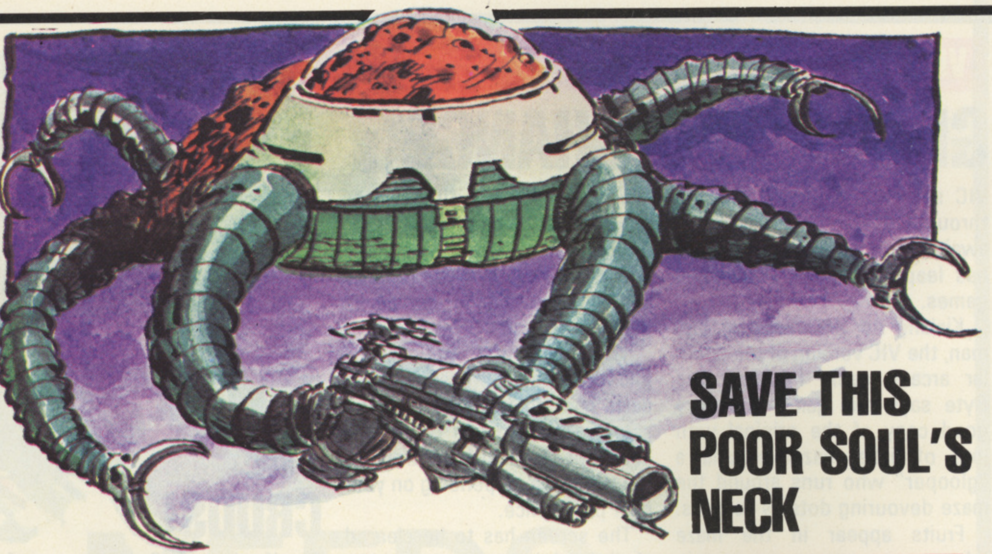
That is, the word according to The Bible of Automata Cartography in its new game. Sticking to the firm's humorous line in games tapes. The Bible takes you through 10 games programs on a journey along the well trodden path of the Old Testament. It kicks off with a game entitled Genesis, and then moves on to Adam and Eve.

Later on in the tape you can relive Moses' experience on Mount Sinai and deliver the 10.

Copies are obtainable from Portsmouth based Automata and costs £5.00. It runs on a Sinclair ZX81 in 1K.

BEST SELLERS

THE MONSTER FROM OUTER SPACE



A bright red monster from space is still tormenting Philips G7000 owners up and down the country, causing widespread frustration and havoc.

Running riot on video screens is Space Monster, which was recently topping the sales figures for Philips. The game is a space invader spin-off, but with additions which demand some quite different tactics from the player.

The space monster itself lurks at the top of the screen behind a bank of robots which form the main part of the tentacled blob's attacking force. Each robot is equipped with a cannon from which he hurls down bombs and a shield which he can use for protection. It sounds quite impregnable but the robots' weakness is that their shields must be held to one side for them to fire.

A tank is your means of attack and defence. You have three reserves and three shields to hide behind. Whenever the blob or his robots score a direct hit on the player's tank it turns him into a little human creature skating to find refuge behind a shield. Each time he needs another reserve tank one of the shields disappears from the screen, leaving the player more open to enemy fire. If he is hit while tankless the game ends in victory for the Space Monster.

Space Monster is the closest Philips has come to a space invaders' type game.

But it does have some innovations all of its own which make it attractive to would-be buyers. The blob is quite obviously a thinking creature and a capable dodger of the player's missiles. It also has a mean streak which will send him hurtling down from the top of the screen to finish the player off, if it senses victory — much more interesting than the unthinking invaders.

The two different varieties of monster also make a change from the usual green meanies and their numerous imitations.

The Space Monster Videopac is available from G7000 stockists and costs around the £15 mark. A worthwhile alternative to the classic game.

SAVE THIS POOR SOUL'S NECK

HANGMAN

Save a soul from transcending into the stratosphere simply by using your brain to unravel one word.

The game hangman which has long been a great favourite with schoolchildren has now been transferred to your video screen.

This game for the Interton VC4000 follows that old guessing game popularised years ago. The computer selects a word which the player, or players, must try and guess.

Quick thinking is also important in this game, because you must guess the right word before the man on the screen is hung. Each time you place a letter of the word incorrectly a section of a hanging platform and its scaffolding is added. Before you know it the entire frame of the scaffold has been erected in front of your eyes. The next stage is the completion of the victim's body itself.

Whenever you make a mistake in the formation of the word one limb of the convict is added.

The game ends either when you have guessed the word correctly, in which case you emerge as the winner. Or, if you can't unravel the hidden word the poor unsuspecting victim meets a very untimely and unpleasant death.

Hangman is written in a 4K ROM cartridge and is produced by Hanimex for Interton. It is available through the firm's UK dealers ranging from Asda Supermarkets to high street specialist shops. Hangman's retail price is listed at £22.95.

THINGS THAT GO MUNCH IN THE NIGHT

Atari is following the current trend of producing cartridges based on the most popular arcade games.

The latest addition to be turned into video computer system form is 1981 success story, Packman.

PACKMAN

Due out in distributors' shops in April, this version sticks closely to the original concept. You operate a circular mouth-opening creature which speeds along the paths of a maze, sometimes referred to as a house. Littered along the paths are small dots, each one representing points, for the hungry Packman to consume.

Other characters in the maze are ghost-like creatures which move out from a central square of the maze at regular intervals. These run around the corridors, sometimes chasing your gobbleman and sometimes with you in pursuit of them, if you have managed to eat an energy post.

Successfully chasing and munching a ghost, helps the player to score bonus points. These are displayed on the screen where the action took place. And a fruit is displayed at the centre of the screen which can also be consumed for extra points.

With every cleared screen a new fruit from the series, which is worth more points, appears within the labyrinth.

There are three lives for your man to play with during the game, and as play progresses the number of ghosts increases, making your life more difficult. The game continues as long as you keep your lives without being devoured by the ghosts. When you clear the maze of all the dots, the screen flashes up a new one.

Available from U.K. distributor Ingersoll this top of the range cartridge costs £29.95.

VIDEO SCREEN

BAFFLED BY THE BLACK AND WHITES

BACKGAMMON, CHECKERS

Two traditional board game favourites have been given a new lease of life through the video medium.

Checkers and backgammon have been transferred to the television set via the Interton VC4000 Video Computer system, for enthusiasts who cannot always find human opponents to play against.

Both are easy boards for the computer to display and combine simple rules with plenty of scope for tactical play so the computer makes a worthwhile opponent, even it if it will have a tendency to play safe.

Checkers or draughts as it is commonly known, is displayed as a board and pieces and there is no deviation from the traditional rules. You can play either black or white — black goes first — and then try to out-think your computer opponent. Be wary of the computer if it appears to be offering up a sacrifice — it probably has something nasty planned for you.

As usual the opening strategy determines who ends up with the most kings and that is the player who will usually win the game.

Backgammon too keeps to the traditional rules but without the gambling element, it is not as skilfull as the original. It will, however, help to sharpen up the players' skill at outmaneouvering an opponent on the board. And it will teach beginners the folly of leaving an exposed piece in a vulnerable position.

For those of you who have never played the game, it involves moving counters around the board in the opposite direction to your opponent and trying to get yours home first — but if a counter is left alone it can be captured by your opponent and returned to start.

These cartridges are available from retailers in the U.K. from specialist dealers and some large department stores. The retail price is £16.95.

BURN UP THE CIRCUIT

GRAND PRIX

Turbocharged cars are currently burning up the formula one race tracks — and now you can catch up with these high powered machines in this latest Activision game.

You are at the wheel of a highly tuned turbo race car lined up on the grid for a Grand Prix.

The circuit ahead is filled with numerous hazards which you must overcome with expert control of the Atari joysticks. Apart from avoiding other vehicles watch out for oil slicks. If you drive over them you're taking a risk and it could cause a multiple pile-up.

Manoeuvring the car round the circuit is tricky. Not only are there sharp bends to contend with, but you also have to drive your car over narrow bridges.

The race is run against the clock which means you must combine speed with safe driving to come out on top.

Grand Prix is produced by Activision for the Atari Video Computer System and has good graphics and sound effects making the game more realistic. It sells for the standard price of £14.95.

● Philips' new concept in video games combining a television adventure with an actual playing board is to be unveiled this month.

Quest for the Rings, which featured in our March issue, is scheduled to be on distributors' shop shelves in April. A price is still to be decided but it is likely to be more expensive than the standard Philips Videopac price (£14.95).

TAKE THE TRENCH TO DARTH'S STAR

STAR STRIKE

Relive the final conflict of Star Wars against the Empire's Death Star when failure means your planet's destruction.

Take the role of Luke Skywalker on his do-or-die mission to blow up Darth Vader's giant man-made planet. In Star Strike you have to guide your Star Cruiser through space, dodging enemy space fighters as you travel to the Death Star.

Missiles whistle past you and you must retaliate with the deadly laser guns positioned on your star cruiser. If you successfully navigate through the space hazards and reach the narrow trench, which you must fly along to destroy Darth Vader.

Expert flying skills are vital for success because the trench is lined with obstacles and filled with enemy fire. Use your photon torpedoes and maneouvre your ship away from the attacking crossfire like laser posts positioned on the walls and floor.

Judge the distance from your ship to the trench carefully and when you approach the last few miles focus your sights on that single exhaust vent — the only weak spot in the trench.

If you've got an Intellivision, Star Strike is available from stockists now, the price is £19.95. Intellivision owners can also subscribe to a new newsletter produced by Advanced Consumer Electronics, which gives details of the latest cartridges and new developments planned for the Intellivision and Acetronic MPU1000.

AT LAST!

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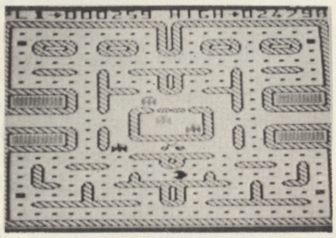
VIC SOFTWARE

VICMEN



A full-feature version of the popular "Puckman" arcade game for the UNEXPANDED VIC. Written entirely in machine-code for fast action.

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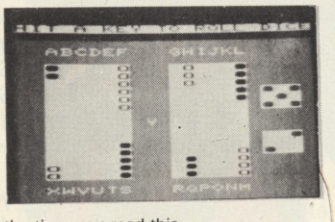
VICGAMMON



Standard Backgammon game for the VIC with 3K expansion. Rapid computer responses. Instructions on how to play are included.

SUPPLIED ON CASSETTE at £7.00

More VIC software will be available by the time you read this. Phone 051-227 2642 for details. Generous DEALER DISCOUNTS available — **phone Dave on 051-227 2299** for details.

Sinclair ZX81 ★ NEW RELEASES ★

DICTATOR

Another great adventure game from Bug-byte for the 16K ZX81. This time, you are the president of a small state. The object of the game is to avoid revolution, escape assassination attempts, and maintain your popularity, while managing the secret police and army, and maintaining a secure economy. This is a very complex simulation, utilising the whole 16K, and the cassette comes with an 8-page booklet giving full instructions and hints on how to survive.

Can you stand up to the pressures of life as a dictator, and prevent unrest from spreading before it's too late? **PRICE £9.00**

CONSTELLATION

Turn your ZX81 into a telescope! This program will produce a simulation of the night sky as seen from any chosen point on earth at any time this century. You can point your "telescope" in any direction, move it up, down, left and right, zoom in or pull out, and display the stars by magnitude or constellation. **PRICE £8.00**

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INVADERS	**£4.00**
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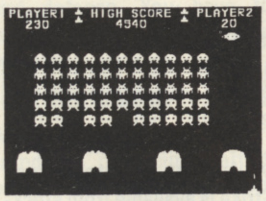
ACORN ATOM SOFTWARE

Acorn Atom INVADERS



"The best excuse to expand your Atom. It is a superb version of the standard game, tough and fast" Your computer Nov '81 12K, graphics mode 4 **ONLY £8.00**

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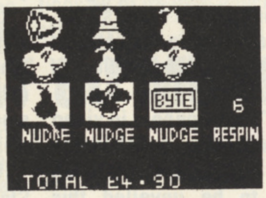

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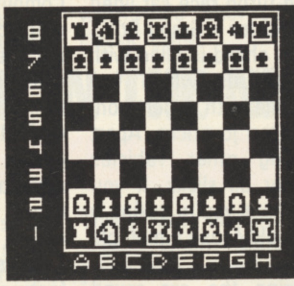
CHESS



THE PROGRAM YOU'VE BEEN WAITING FOR!

Fantastic machine code chess game for the 12K Atom. Features include: screen (high res. + alphanumerics); many levels of play; castling & en passant; computer plays black or white. Supplied on cassette with instructions. *PRICE ONLY £9.00*

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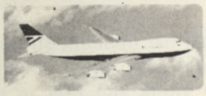
747

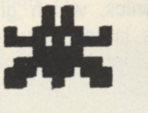


FLIGHT SIMULATION PROGRAM FOR THE 12K ATOM

Written for Bug-byte by a 747 pilot. Accurate simulation of a 747's cockpit display (airspeed, altitude, rate of climb, attitude, flaps, etc., and graphic display of horizontal situation and attitude); allows you to guide your craft to the landing strip. On making your final approach the display changes to a high-resolution 3D representation of the runway coming up to meet you. A real test of skill. Finding the runway is quite a challenge — landing safely is even more difficult. If you succeed, you are awarded a skill rating and the chance to take off and try again.

REQUIRES FLOATING POINT ROM **PRICE ONLY £8.00**

GALAXIAN



Fantastic high-resolution (mode 4) arcade game with fast-swooping aliens, excellent sound effects, and high score. 12K

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BACKGAMMON (7K, BASIC)

The program draws out a representation of a backgammon board and allows you to play the standard game against the computer. Playing instructions are not included, but if you can't already play the game, there are several books available to teach you, and the Atom makes an ideal, ever willing partner to build up your playing strength against.

Computer responses are rapid (approximately 10 seconds) and the program will not accept illegal moves. Dice throwing is controlled by the computer. **£7.00**

LABYRINTH (12K, F.P., BASIC, GR.Mod2A, sound)

High-resolution colour graphics (also effective in Black & White) make this 30 maze program one of the best versions available. To help you find your way through the bewildering array of corridors of the 30 x 15 cell random maze, you can call up to a 20-map of the maze. In the harder game option, this map shows only the portions of the maze which you have explored.

Your task is to find your way to the treasure room at the centre of the maze and then escape through the exit. To make things more difficult, several monsters (including the dreaded Minotaur) are loose in the maze, and you will have to fight you way past them. The types of monsters present, and their weapons can be altered by the user, if required. **£7.00**

REQUIRES THE FLOATING POINT ROM

LUNAR LANDER (12K, BASIC & s.c., Gr. Mod4)

A highly addictive arcade style program. A rugged lunar landscape is drawn out and you have to attempt to land your craft safely on the flat areas, by varying the thrust of your main & steering rockets. If you succeed, the ship takes off, and you have to try to land it again, under slightly more difficult conditions. This continues, until you have reduced 3 ships to heaps of rubble.

On screen readout of fuel and score. Several skill levels. A record is kept of the high score. If you are a sufficiently expert pilot, you will be rewarded with extra ships. Definitely a cut above the average lunar lander!! **£5.50**

GOLF (6K, F.P., BASIC)

An 18 hole, par 72 course, complete with fairways, rough, bunkers, trees, streams & greens. Skill and careful club selection are required to get round with a good score. To make things more difficult, you have to specify a fault in your game, which the program will reproduce, and your handicap. At the end of the round, the program produces your scorecard for the round.

A highly entertaining program, which is likely to have you up late into the night straining for a par! **£5.00**

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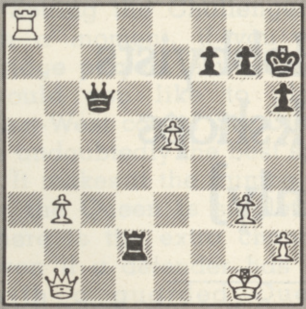
CHESS

Will a chess computer ever be able to take on a grandmaster and give him a challenging game? Well, maybe the masters of the game will become wary of the machines after reading the results of a fascinating experiment reported by grandmaster Raymond Keene in Massacre at Merano — his account of last year's world championship between Anatoly Karpov and Viktor Korchnoi.

After the match some of the positions from the eighteen games were put to Sci Sys Chess Champion Mark V, one of the strongest of the commercially available chess machines.

The results were impressive on a number of occasions the computer was able to improve on the play in the match. The following position occurred in game nine, with Korchnoi White.

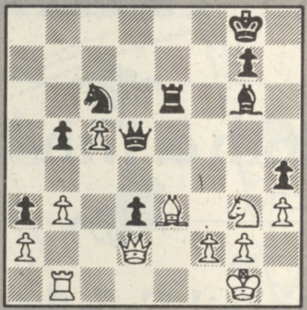


Korchnoi has just played 41. Q-N1ch and Karpov now replied 41. . . . P-N3 and the game continued 42. Q-KB1 (forced to avoid mate on KN2), Q-B4ch; 43. K-R1, Q-Q4ch and white resigned (after 44. K-N1, R-Q8 wins the queen). This win gave Karpov a 4-1 lead — draws did not count in the match.

It is hard to imagine that Black's play can be improved here, but in the diagrammed position Chess Champion Mark V, after about 30 seconds analysis, found the improvement 41. . . . R-QB7!

This kind of move is difficult for a human player to perceive, since it pins Black's rook against his king, an action which tends to be avoided instinctively by strong players. In this case, White again has to play 42. Q-KB1, to avoid checkmate and then 42. . . . R-B8 wins White's queen, more quickly than by the line chosen by Karpov!

In the next position, Korchnoi — Black — with very few minutes left to reach the time-control on move 40 had hastily moved his queen to Q4. Karpov now has 35 minutes to make his next move but — probably to keep up the pressure on Korchnoi — he replied instantly and played 40. N-B1 to save his threatened knight.



Korchnoi now played 40. . . . B-K5! With an irrestible attack on White's king knight pawn.

Karpov played 41. B-B4 and adjourned the game until the next day, but resigned without resuming — after Black's 41. . . . BXKNP; 42. N-K3, Q-B6; 43. NxB, R-K7; 44. Q-Q1, QxBPch; 45. K-R1, QxN mate is one likely continuation.

Karpov's blunder in the diagrammed position gave Korchnoi his first win of the match.

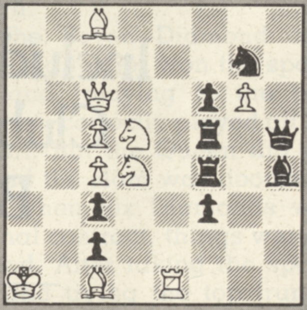
How did Mark V handle the position? After 38 seconds' analysis, it found the far superior alternative 40. N-K2! Now Black cannot take the knight without losing his queen and white threatens 41. N-B4 which would fork Black's queen, rook and bishop, attack the queen pawn and defend White's own king knight pawn.

These and other examples clearly impressed grandmaster Keene, not least because of Karpov's decisive and accurate play throughout almost all the match.

The same machine scored a further success in a challenge contest arranged against grandmaster Dr John Nunn — an extremely strong chess-problem solver — at the end of a recent international tournament at Brighton. Man and machine were each set six difficult problems, selected by the vice president of the Problem Commission of the International Chess Foundation.

One of the problems was this prize-winning composition by the Soviet problemist L. Zagorujko, which appeared in 1972.

It is White to play and mate in four moves. Nunn was unable to find the solution to this extremely difficult problem, but the Mark V did so; in fact it found *three* solutions — an extremely embarrassing outcome since a problem is considered spoiled if there is more than one solution found.



As an indication of the complexity of this problem, the reader is invited to work out the analysis after the key move 1. R-K8!

For a computer to do this is impressive, but to find two other solutions was beyond the powers of the many problemists who have examined the position since then.

However, there is a considerable difference between analysing a problem position and playing a game.

The Mark V's achievements should not be taken to suggest that a grandmaster program is imminent, but they do show that in some areas of the game computers are already capable of more effective deep analysis than humans.

By Max Bramer

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BRIDGE

BY ALAN HIRON

Here's how the Fidelity Bridge Challenger dealt with a recent hand encountered during match-play.

Although the Mark II Challenger has the facility of generating its own random deals it seemed more sensible to try it out on an actual hand. This way you get a human comparison as well. This was the hand, dealt at love all:

North
S K Q 9 8 7
H Q J 7
D Q 10 7
C 3 2

West	**East**
S A 5	*S* J 10
H A 10 9 4	*H* K 6
D K 5 3	*D* A J 9 8 6 2
C K Q 6 4	C A J 5

South
S 6 4 3 2
H 8 5 3 2
D 4
C 10 9 8 7

Setting the Challenger aside for a moment, if you were a bridge player, in what contract would you like to play the East-West cards? Six Diamonds is undoubtedly the best spot.

It makes if the trumps are 2-2 or the Queen is singleton and there is the extra chance that even if a defender has started with a guarded Queen of diamonds he may have to follow to three rounds of clubs.

First Challenger was set to work with the instructions that it was playing a weak no-trump (13-15 points) and that there was no opposition bidding. Its auction went:

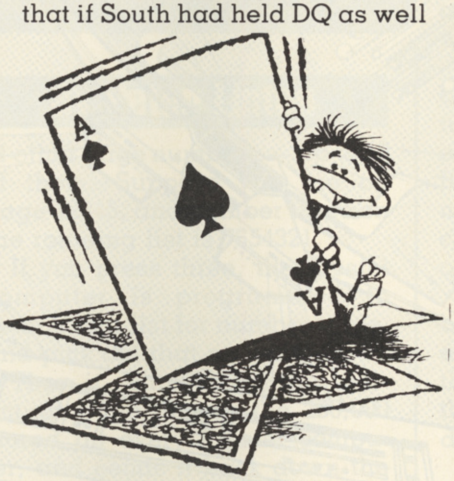
West	**East**
1C	1D
1H	1S
3D	4NT
5H	6D
pass	

Not at all bad! The One Spade bid was 'fourth-suit forcing' in the best modern style and both halves of Challenger's split personality valued their hands well after that.

For a second run, East-West were instructed to play a strong no-trump 16-18 points. It shouldn't have made any difference to the final contract, but:

West	**East**
1NT	4C
4S	5C
5S	7D
pass	

The Four Clubs bid — and indeed the Five Clubs bid — were Gerber and on finding South with two Aces and two Kings North plunged on to the grand slam. It is perfectly true that if South had held DQ as well as his other high cards he would have bid exactly the same and Seven Diamonds would have been a doddle. As things stand, it is not an outrageous contract.



The next thing to try was a little interference bidding. Suppose that over One Club North overcalls with One Spade. Should this affect things? Apparently it did for now the bidding went:

South	**West**	**North**	**East**
	1C	1S	2D
pass	2NT	pass	3NT
pass	pass	pass	

Let us be fair. The grand slam was not too wild, the small slam distinctly better, and nine tricks in no-trumps were simple. But the difference in valuation is intriguing.

What about the play of the cards? It was in this area that Challenger Mark I had been at its weakest, failing to draw trumps or sometimes drawing them too enthusiastically.

It had never seemed to count tricks and refrained from taking finesses that were necessary. Perhaps over-zealous advertising had suggested that Challenger played the cards well. Both large stake money matches and legal action were threatened by its detractors and certainly the play had to be tightened up.

Even now there are problems. It is extremely difficult to lay down a set of anxioms on how to plan the play of a hand — there are so many variable factors.

On the deal we have been considering Challenger had no trouble at all in its Three no-trump contract. After the lead of a top spade, it cashed its nine top winners — albeit in a slightly odd order, but efficiently enough.

In the Seven Diamond contract, Challenger won the spade lead and, playing to the percentages, correctly played off DK and DA. But the Queen did not fall and the slam was doomed.

But when Six Diamonds was the final contract, things weren't so good. After taking the spade lead and trying the top trumps unsuccessfully, the normal play is to try the clubs, hoping to get the losing spade away before the defender with the Queen of diamonds can trump.

Any tournament player would see this immediately and would waste no time in trying it out. Not so Challenger, who rather weakly conceded a trump trick and so went one down without even trying the Clubs.

Perhaps he wanted to get started on the post-mortem and criticise his partner's bidding!

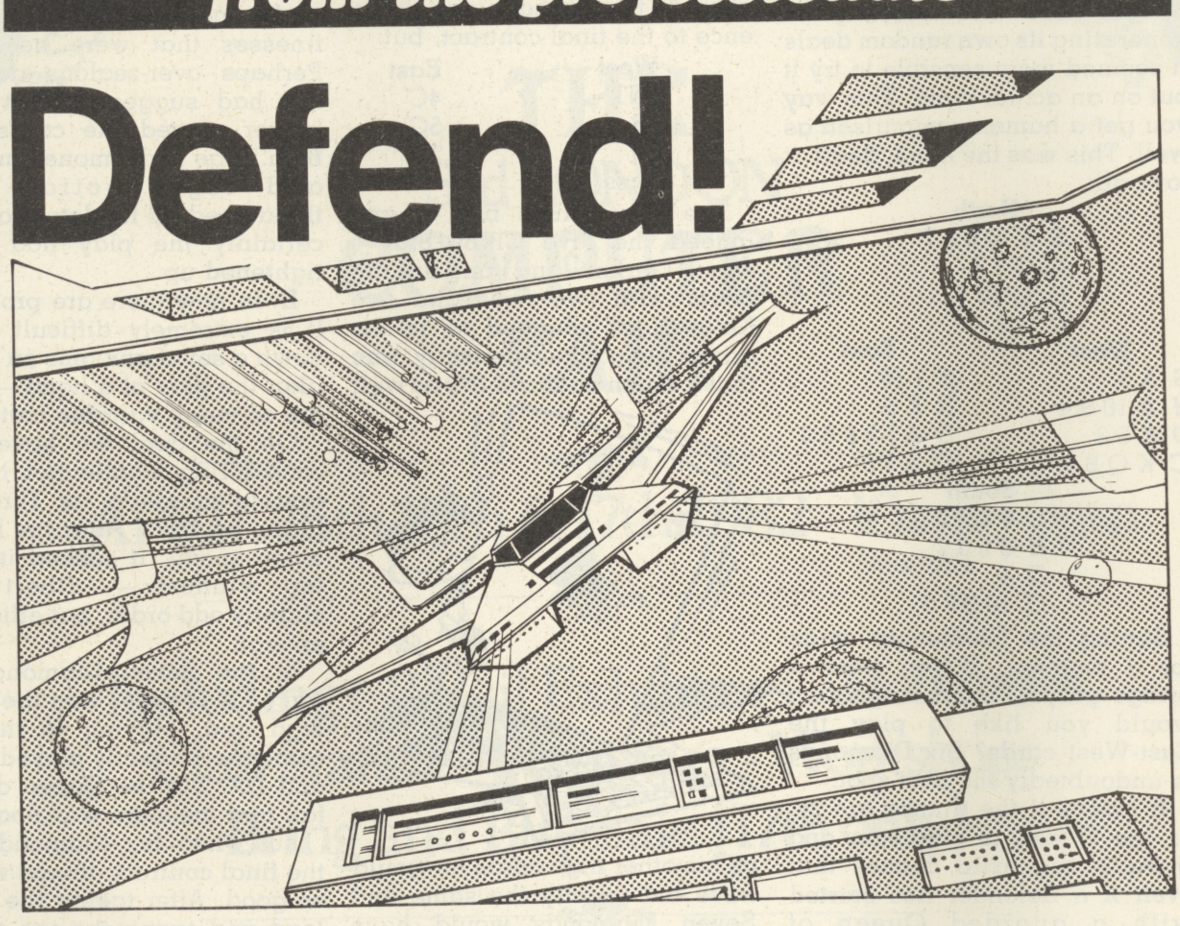
Incidentally, the best line of play doesn't work, but a finesse of DJ the second round of the suit would have done. Whatever Challenger's faults, he doesn't peek!

INNOVATIVE

TRS 80-GENIE SOFTWARE

from the professionals

Defend!



First there was Invaders, then came Asteroids, and now DEFEND!!!

Carrying on in the same tradition, Defend is a fast arcade type action game, complete with sound effects. Enemy spaceships come at you fast and furiously. If you succeed in shooting them down before they get your ships, you must still get yourself through a meteor shower (but at least they don't shoot at you) and finally, if you emerge unscathed, you must navigate a tunnel in order to get yourself completely out of danger. An enthralling game with excellent graphics, personalisation of highest scores and points bonuses. One of its best features is the ''crisp'' and immediate control the player has over the manoeuvreability of his ship which includes diagonal movement. Machine language, of course, for speed. A matter of taste, but we think it beats Invaders and Asteroids. Suitable for TRS-80 Models I and III and all Genie models.

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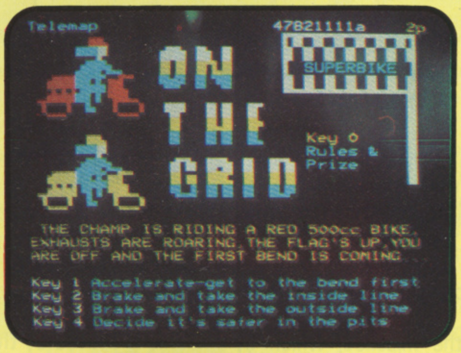
PRESTEL

Ever since Prestel started three years ago, games have been the single most popular thing on it. That's not what it was designed for, but games are a very good way of finding out about Prestel. There are now dozens of different games, ranging from short and simple ones to fairly complex ones.



```
Telemap                          47821111a   2p
         ON                     SUPERBIKE
         THE          Key 0
         GRID         Rules &
                      Prize
 THE CHAMP IS RIDING A RED 500cc BIKE.
EXHAUSTS ARE ROARING.THE FLAG'S UP.YOU
ARE OFF AND THE FIRST BEND IS COMING.

Key 1 Accelerate-get to the bend first
Key 2 Brake and take the inside line
Key 3 Brake and take the outside line
Key 4 Decide it's safer in the pits
```

By Peter Linton

Although Prestel runs on computers, there is a vital difference between it and even the smallest micro-computer. Prestel has no processing power. It cannot perform calculations, store variables or do clever things with the display — at least, not at the moment, but it's coming. What Prestel does have is simplicity, colour and routeing. All games are therefore essentially games of choice.

The key point about Prestel is that it is a computerised information system that anyone can use. All you need is a numerical keypad, and with that you can control and drive the computer. You don't need to be an expert.

Colour is a very important element in Prestel — it gives it much greater impact than ordinary monochrome computer displays.

There are six colours, plus black and white. Three are the primary colours — red, blue and green. A colour T.V. screen is coated in thousands of phosphor dots which give out these colours.

If you mix the primaries, you get some surprising results — red and green together produce yellow. Blue and green become cyan — light blue — and red and blue is magenta. Mix all three primaries together to get white.

If that puzzles you, think what would happen if you could shine all the colours of the rainbow back through a prism. You would not get a muddy brown colour, but vivid white. It's the same on a T.V. screen.

Routeing is the secret weapon in Prestel. Each page on a T.V. screen has an invisible "back" side to it, with various bits of information on it.

The most important thing — after the page number — is a list of other page numbers — up to 10 of them. Suppose you are on page 12345, and number three on the routeing list is 7654321.

If you press three, the Prestel computer is programmed to search that list for number three, and pick out that new page.

Then it searches for that particular page among the 200,000 stored on every Prestel computer, and sends it back down the phone line to your set. The amazing thing is that all that takes only a fraction of a second. And it can be repeated as many times as you like. It is as if you had a filing cabinet from which you could extract a sheet of paper in an instant — and that sheet could call up further sheets just as fast.

This facility presents great opportunities and challenges for Prestel designers. Effectively it means that you must think in ten-dimensional terms.

Any page can lead to any of ten other pages, which in turn can lead to ten further pages, and so on, for ever. It is almost impossible to put that down on paper, which is only two-dimensional, and things like flowcharts are usually little help.

A Prestel designer therefore has to visualise a logical path through a maze of information — and allow for all the alternatives.

It can get pretty mind-boggling at times, but it does provide a useful mechanism for games. It means you can provide a range of simple choices. All the player then has to do is to key the number of his choice, and this calls up the result — with a new set of choices.

A good example is a game called Superbike on 4782111 (pictured above). You are racing ex-world champion bike racer Barry Sheene, and you have to make a constant series of choices, whether to overtake him on the inside or outside.

This routeing structure is the basic mechanism of almost every Prestel game, and a look through the games index shows the ingenuity that's gone into devising variations.

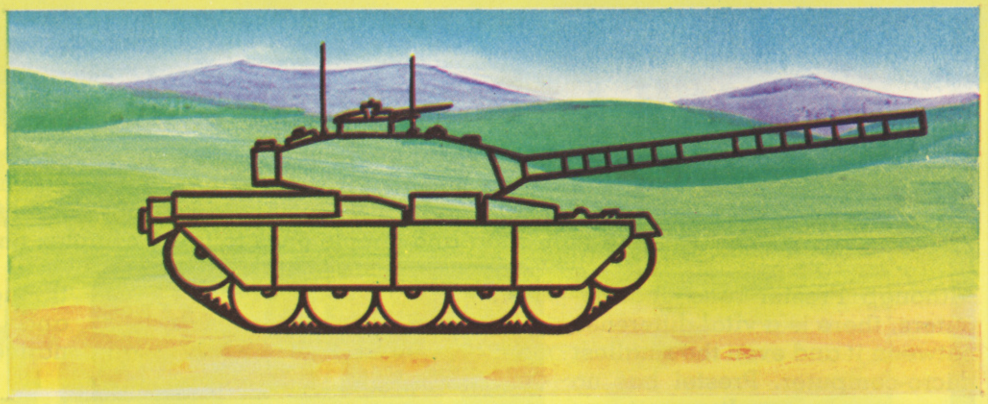
By providing a steady series of choices, it can provide a large combination of different possibilities. The catch is that if you play the game again, you get the same choices. There is no randomising element.

Another catch with designing a Prestel game is that you need to provide for every conceivable possibility, otherwise some players are going to get stuck. That can involve large numbers of Prestel pages for games where there are many choices. Think, for instance, how many different variations there can be in Noughts and Crosses. On Prestel that requires several hundred pages!

Prestel games are not as "intelligent" as most micro-computer games. But there are dozens to try, and new ones being devised all the time. Now that you know how they work, you'll enjoy them even more!

KEEPING WARFARE IN PERSPECTIVE

TIPS ON BATTLE ZONE



Patience is not usually demanded of arcade players, who are happier feverishly pushing buttons to destroy as much as possible before the next missile with their name written on it, homes in.

Battle Zone a unique game, where the player is encouraged to manoeuvre until the right opening to hit back comes along.

The game simulates tank warfare giving a view from inside the tank. Tank controls are also faithfully duplicated with two levers which can be pushed into forward or reverse position simulating the two tracks of the tank.

Beginners quickly learn that pushing both levers forward sends their tank off in that direction, while pulling them back sends the machine into reverse. With one at full reverse and one at full forward the tank turns quickly on the spot.

But even with a good shooting eye, this knowledge is not enough to help a player survive for long. As turrets swivel in your direction, the best tactic is to go off diagonally to escape.

This is achieved by pushing one lever hard forward and the other only halfway forward. The enemy's shells will fall just behind you. When you have gone right past the tank, check the radar to see the enemy's position behind you. Then reverse hard until it appears on the screen quite close up and turn on the spot. You will have two chances to get in a shot before the tank is in a position to fire at you again.

If you miss with both, then repeat the tactics. One danger is that you may run into the enemy as you reverse and then you will be helpless but the radar check should prevent this.

After 30,000 has been scored, the super tanks are unleashed, these turn much faster but the same tactics work, although you will only have time for one shot.

Among the other inhabitants of this machine is a flying saucer which flies swiftly along the back of the plain. These are well worth hitting if they pass in front of you (5,000 points) but it can be lethal to chase them, even though they don't fire back, as a tank may use this opportunity to creep up on you.

With the missiles, which fly towards you from the back of the screen, it is possible to increase your chance of hitting them by going into full reverse and waiting until they get up really close.

It is also possible to put an obstacle between you and the missile which will cause it to miss but it will come back to try again — be ready for it.

A good player uses the radar to place tanks as half of them will materialise behind you. Scoring 150,000 will give the player a 15/20 minute game but beginners should watch for games which offer extra tanks for your money, to learn on. Our thanks go to Simon Eyre of Waterlooville, in Hants, for the tips.

THE RECORD BREAKERS

Breaking new ground on arcade machines is turning into an endurance test as much as it is a test of skill.

This is proved by the fact that four students from Kent University are planning to spend **eight days** at the controls of an asteroids machine to put their names in the record books.

David Birkett, David Hill, Tony Thomas and Alan Tilling are the four whose endurance will be tested in shifts on the university's machine in Canterbury. As this issue goes to press the university's rag week will be taking place around the four of them as they attempt to return an unbeaten score of 100 million.

If their attempt succeeds it will leave the present world record for dead. Atari, which manufactures the Asteroids machines, monitors the world record and it presently stands at 30,100,000, knocked up in 50 hours by a New Yorker.

David Birkett claims all four Kent players have previously been over the million mark: "I have scored five million in a double game which lasted eight hours and we were left with 113 bases.

"We will have no shortage of people willing to invigilate the attempt as we are being sponsored for the rag week charity and any money we make will be going to spina bifida sufferers.

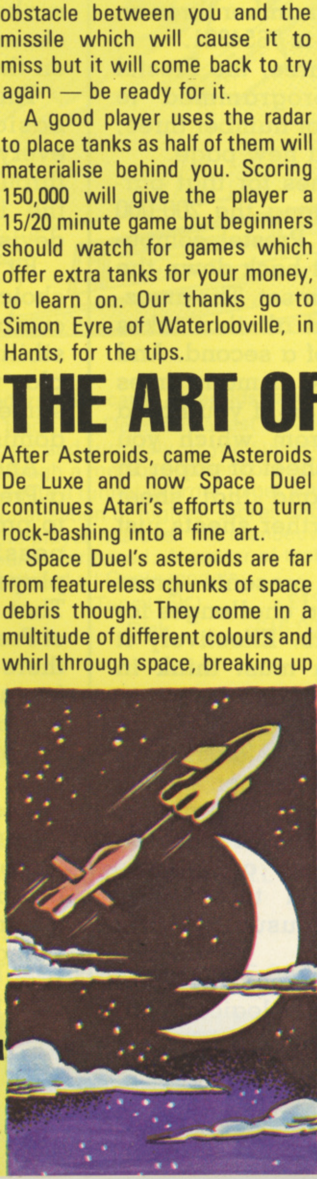
Are you record-breaking material? From our next issue we will publish some of the best scores we have heard of on popular arcade machines to give top scorers something to aim at. If you can beat our highest scores and are willing to prove it, please write and let us know.

THE ART OF ROCK BASHING

SPACE DUEL

After Asteroids, came Asteroids De Luxe and now Space Duel continues Atari's efforts to turn rock-bashing into a fine art.

Space Duel's asteroids are far from featureless chunks of space debris though. They come in a multitude of different colours and whirl through space, breaking up under fire into smaller segments of themselves. Alien spacecraft still frequent the pathways between them and your craft is still equipped with shields to protect itself from rogue meteors.



But the most interesting feature of Space duel is that two people can play at once. It is possible for both to take to the screen as enemies and go individually for a high score, or play as a team to knock out as many asteroids screens as possible between the two of you.

A further break with tradition is that the two spaceships can team up to give real fire-power. A chain is tied between the two and they move around the screen in tandem, firing independently, but moving as one.

This takes some getting used to and teamwork is very important when moving out of the way of an oncoming asteroid. One craft can pull the other out of harm's way, but if both try to go in different directions at once, the meteors will come out on top.

The advantage is the increased fire power which can blast an asteroid out of harm's way very quickly.

When both craft are on the screen at once, a good player can help a beginner to pull through as the game continues until both have lost the required number of lives.

HERO WITH A YELLOW STREAK

AMIDAR

The Amidar may look like cuddly toys but their touch is deadly.

The game which is named after these creatures combines the fashionable arcade themes of maze chase and space capture.

In Amidar, you take the part of a gorilla, who swings around the screen on blue bars which are covered in white fruits. As he moves along the bars he clears them of white fruits. If all four sides of a square all cleared the centre is filled in red and gradually the screen becomes a patchwork of red rectangles.

There are seven Amidars on the screen. One runs around the outside four corners and the other six move up and down always turning the nearest corner. These creatures are not as intelligent as the Puckman "ghosts" when it comes to hunting down their prey.

All the dots must be erased to clear the screen and start on the second area of the game. This time a framework of red lines comes up on the screen and the player is transformed into a paint roller. The Amidars, which resemble toy cats, still undertake their regular patrols of the screen.

The aim on this screen is to use your paintbrush to pick up a yellow streak at the bottom of the screen and extend it. With the Amidars making life as hard as possible you first have to run the yellow around the border of the nearest rectangle, filling it in with a bright green and pocketing the bonus score which the space previously featured.

From this start it is possible to fill in the entire screen, with the really big bonus scores waiting for you at the top.

It is important to keep a cool head as the Amidar are quite capable of turning away from you even when they seem to have you surrounded. Just keep a check on where the next corner comes up and be sure that they will turn down it.

EXPLORE THIS OH-SO LENGTHY TOMB

TUTANKHAMUN

The treasure of the Pharaoh's tomb is awesome — but so are the creatures that guard it!

The Earl of Carmarthen's expedition into the mysterious depths of King Tut's famous pyramid proved hazardous — but arcade players have to face even more terrors.

The explorer who braves this video pyramid resembles a cartoon prospector character complete with a bushy white moustache and with tools strapped to his back.

This treasure hunter is also armed, which is just as well because he will have to face a horde of guardian creatures in this tomb.

This motley crew of monsters include a mummy and a cobra as well as some less explicable dungeon denizens. Their touch is deadly.

The labyrinth which leads to the treasure is long and tortuous.

The monsters hunt in a pack — some trying to get in behind you and others trying to draw your fire before leaping into some half forgotten recess.

Your explorer has a limited amount of ammunition in his weapon which occasionally needs replenishing. But his main deficiency is that he can only fire horizontally and is in real danger if he ever gets trapped in a vertical part of the maze.

To help him avoid this happening the top of the game screen offers a "radar" display of the whole maze. On this the monsters can be seen as white blobs, converging on you from the far end of the maze.

Although it doesn't help you much in dodging the advancing horrors, it does prepare you for their charge so you can ensure a long horizontal passage stands between you and them.

You have three lives to try and make it to the treasure but they are not nearly enough — especially since, you are returned to the beginning of the tomb each time the monsters catch you.

The biggest danger among the first batch of creatures is the sarcophagus-like being which is invulnerable to your fire — or so he seems at first. In fact a sequence of three hits will make him turn away and rethink his avenue of attack.

LADYBIRD KNOCKS OFF THE SPOTS

LADYBUG

Any gardener will tell you that ladybirds are a force for good on the rosebushes.

They are now also undertaking heroic feats in the arcade in a new maze game.

The player takes the part of the ladybug, which also gives its name to the machine, and sets off on a spot consuming trip around the maze.

In this game the spots are few and far between and the pursuers are in the form of large blue beetles which try to corner your rampaging insect.

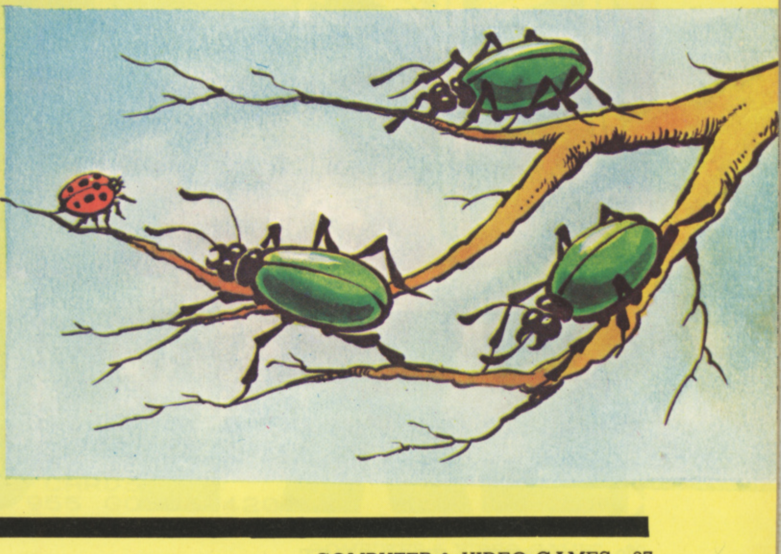
But you do have one big advantage over your adversaries, your ladybird can walk through the maze walls, as these are hinged doors which the creature can push open.

As one way opens another is inevitably closed as the door swings around in 90° to seal a different passage. The blue beetles cannot pass through the doors.

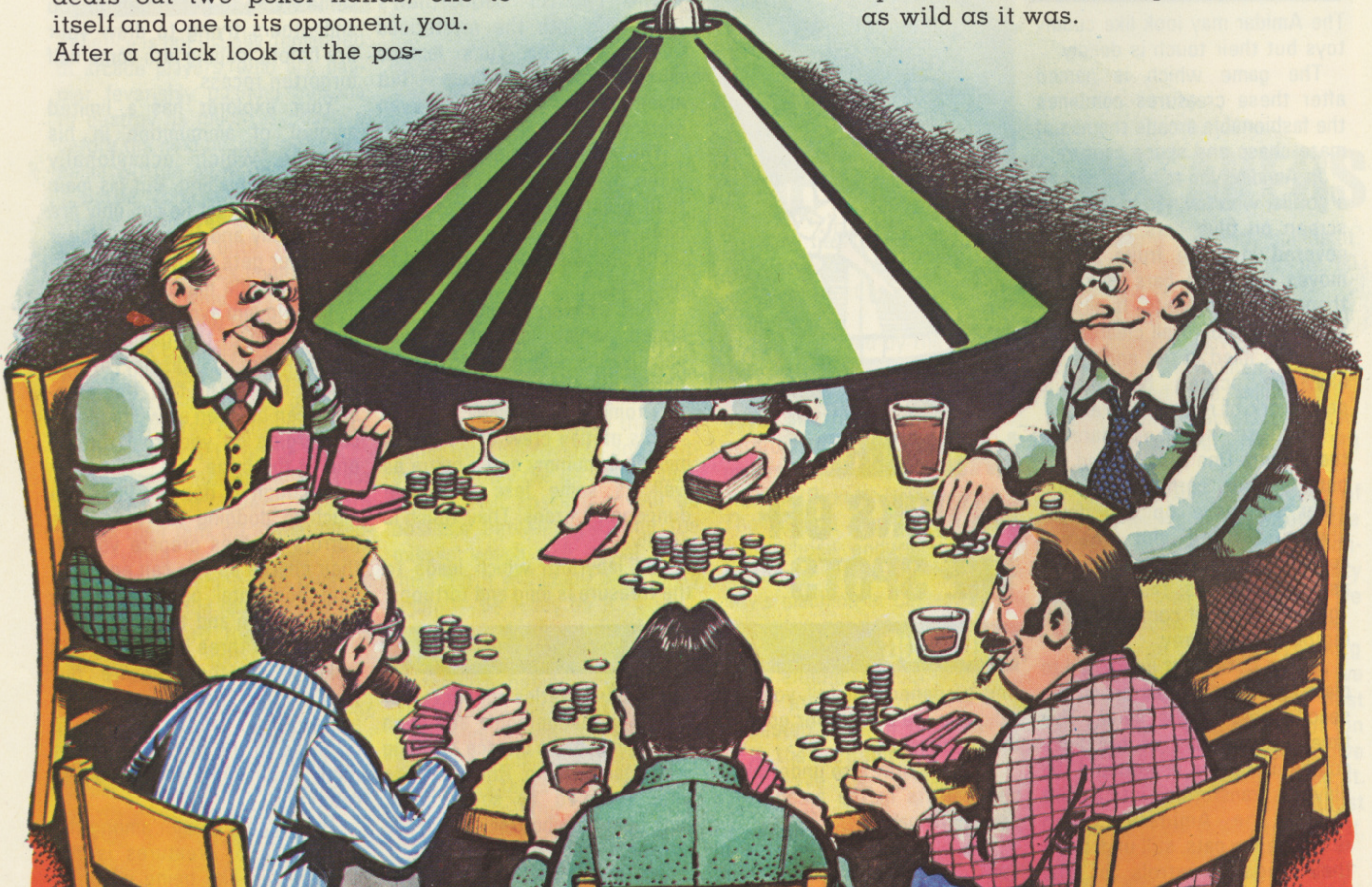
The good player will plan to block off the beetles completely, surrounding them within four doors and leaving them helpless.

These blue beetles appear rather slow and cumbersome and even a beginner has a chance of doing well against them. But these are later replaced by some faster pink beetles who track down the ladybirds much more swiftly.

An interesting game for the beginner but the controls for the ladybird are not designed for fluid movement which can result in frustration when they do not respond quickly enough.



The Sinclair ZX81 has a real poker face — it gives nothing away about its hand. No beads of sweat will form on its keyboard if it's bluffing on a Jack high and you won't notice its RAM-pack trembling with excitement if it holds a full house. In draw poker, claim the best players, the early part of the game is all mathematical odds and the final betting is all down to psychology. This program will hardly give the ZX81 a believable personality but it will help the uninitiated learn how to play poker hands and how much to gamble on them. The ZX81 deals out two poker hands, one to itself and one to its opponent, you. After a quick look at the possibilities of your hand, you must key-in how much money you are willing to gamble on drawing the right cards against the ZX81's hand. The ZX81 will always cover your bet and often give you odds if it thinks you have made a rash decision. Then after you have changed your hand in search of that elusive full-house, the ZX81 does the same and it's winner takes all. Not quite Cincinnati Kid stuff but it will give a good understanding of the game and show why experienced gamblers never draw to an inside straight. After all everybody should know how to play poker, if only to help them understand why the west was as wild as it was.



ZX POKER

```
  1 FAST
 10 LET AMT=100
 14 DIM Y(2)
 15 DIM X(2)
 16 DIM O(9)
 20 DIM S$(4,8)
 30 LET S$(1)="CLUBS"
 40 LET S$(2)="DIAMONDS"
 50 LET S$(3)="HEARTS"
 60 LET S$(4)="SPADES"
 61 FOR I=1 TO 9
 62 LET O(I)=20-(I*2)
 63 NEXT I
 70 DIM C(52)
 80 DIM H(5,2)
 90 DIM J(5)
 91 DIM T(4)
 92 DIM K(5)
100 DIM H$(8,14)
101 LET H$(1)="STRAIGHT FLUSH"
102 LET H$(2)="FOURS"
103 LET H$(3)="FULL HOUSE"
104█LET H$(4)="FLUSH"
105 LET H$(5)="STRAIGHT"
106 LET H$(6)="THREES"
107 LET H$(7)="TWO PAIRS"
108 LET H$(8)="ONE PAIR"
210 LET N=0
220 FOR S=1 TO 4
230 FOR R=2 TO 14
240 LET N=N+1
250 LET C(N)=10*R+S
260 NEXT R
270 NEXT S
279 FAST
280 FOR N=1 TO 52
290 LET M=INT (RND*52)+1
300 LET T=C(M)
310 LET C(M)=C(N)
320 LET C(N)=T
330 NEXT N
331 SLOW
340 LET N=0
```

RUNS ON A ZX81

IN 16K

BY DAVID LAMB

```
 341 PRINT "YOUR HAND:"
 342█PRINT
 500 FOR D=1 TO 2
 510 FOR T=1 TO 5
 520 LET N=N+1
 521 LET H(T,D)=C(N)*10+T
 522 LET TEMP=C(N)
 530 GOSUB 4000
 540 PRINT T;TAB 10;R$;" OF ";S$
(S)
 550 NEXT T
 560 PRINT
 561 IF AMT>9 THEN LET M=INT (AM
T/10)
 562 IF AMT<10 THEN LET M=1
 570 IF D=2 THEN GOTO 800
 571 PRINT "BET NOW - MAXIMUM ST
AKE: £";M
 572 INPUT STAKE
 573 IF STAKE>M THEN PRINT AT 8,
0;"SORRY - YOU MAXIMUM BID IS £"
;M
 574 IF STAKE>M THEN GOTO 572
 575█LET AMT=AMT-STAKE
 576 PRINT AT 8,0;"
                             "
 580 PRINT AT 8,0;"ENTER NUMBERS
 OF CARDS TO CHANGE"
```

```
 590 INPUT B
 595 PRINT AT 8,0;"
                            "
 600 IF B=0 THEN GOTO 700
 610 LET F=1
 616 LET M=B
 617 LET V=1
 620 GOSUB 6000
 630 IF F=0 THEN PRINT AT 8,0;"I
NVALID REPLY - TRY AGAIN"
 640 IF F=0 THEN GOTO 590
 651 LET TEMP=C(N)
 710 PRINT AT 8,0;"MY HAND:
                            "
 720 PRINT ;"
                  "
 730 NEXT D
 800 REM ANALYSE COMPUTER HAND
 810 GOSUB 2000
 820 GOSUB 2070
 830 IF X(2)<6 THEN PRINT "I CHA
NGE NONE"
 840 IF X(2)<6 THEN GOTO 2145
 844 IF X(2)=9 AND T4<>0 THEN LE
T G=T4
 845 IF X(2)=9 AND G5<>0 THEN LE
T G=G5
 850 LET Q$=STR$ Q
 860 LET G$=STR$ G
```

```
 870 LET B=0
 880 FOR T=1 TO LEN STR$ G
 885 LET I=VAL G$(T)
 886 LET H(I,D)=H(I,D)*10+VAL Q$
(I)
 890 LET Q$(I)="0"
 900 NEXT T
 910 FOR T=1 TO 5
 920 IF Q$(T)<>"0" THEN LET B=B*
10+VAL Q$(T)
 930 NEXT T
 935 GOSUB 7000
 940 IF B<10 THEN PRINT "I CHANG
E CARD ";B
 950 IF B>10 THEN PRINT "I CHANG
E CARDS ";B
 955 GOSUB 4200
```

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```
 960 LET V=9
 970 GOSUB 6000
1000 REM ANALYSE HANDS
1010 FOR D=1 TO 2
1020 GOSUB 2000
1025 GOSUB 2070
1030 NEXT D
1040 GOTO 2145
2000 REM SORT HAND D
2010 FOR F=1 TO 1
2020 FOR T=1 TO 4
2030 IF H(T,D)>H(T+1,D) THEN GOS
UB 3000
2040 NEXT T
2050 NEXT F
2065 RETURN
2070 REM ANALYSE HAND D
2080 LET X(D)=0
2085 LET Q=0
2090 LET G=0
2091 FOR I=1 TO 5
2092 LET J(I)=INT (H(I,D)/100)
2093 LET TEMP=H(I,D)
2094 LET H(I,D)=INT (H(I,D)/10)
2095 LET Q=Q*10+TEMP-H(I,D)*10
2097 NEXT I
2100 FOR C=1 TO 9
2110 GOSUB (3000+C*100)
2120 IF X(D)<>0 THEN LET C=9
2130 NEXT C
2135 LET G$=STR$ G
2137 LET Y(D)=J(VAL G$(LEN G$))
2140 RETURN
2145 REM PRINT RESULTS
2146 LET V=0
2147 LET C=10
2148 FOR D=1 TO 2
2149 IF X(D)<>9 THEN GOTO 2154
2150 LET TEMP=H(5,D)
2151 GOSUB 4000
2152 PRINT AT V,C;R$;" HIGH"
2153 GOTO 2155
2154 PRINT AT V,C;H$(X(D))
2155 LET V=8
2156 LET C=8
2157 NEXT D
2159 REM PRINT SCORE
2160 PRINT AT 16,0;"
                              "
2165 PRINT AT 16,0;
2170 IF X(1)>X(2) OR (Y(1)<Y(2)
AND X(1)=X(2)) THEN GOTO 2220
2180 IF X(1)<X(2) OR (Y(1)>Y(2)
AND X(1)=X(2)) THEN GOTO 2260
2190 PRINT "DRAW - YOUR MONEY RE
TURNED"
2195 LET AMT=AMT+STAKE
2200 GOTO 2291
2210 GOTO 2230
2220 PRINT "YOU LOOSE"
2223 LET WIN=STAKE*O(X(2))
2224 LET AMT=AMT-WIN
2226 IF AMT<1 THEN PRINT "YOU HA
VE RUN OUT OF MONEY"
2227 IF AMT<1 THEN STOP
2228 LET ODDS=O(X(2))
2230 GOTO 2280
2260 PRINT "YOU WIN"
2270 LET WIN=STAKE*O(X(1))
2271 LET ODDS=O(X(1))
2275 LET AMT=AMT+WIN+STAKE
2280 PRINT "£";STAKE;" AT ";ODDS
;" TO 1 = £";WIN;" +","£";STAKE;
" STAKE = ";"£";WIN+STAKE
2291 PRINT "YOU ARE £";AMT;" IN
CREDIT"
2300 PRINT "ENTER 0 FOR ANOTHER
DEAL"
2310 INPUT Q
2320 IF Q<>0 THEN STOP
2330 CLS
2340 GOTO 279
3000 REM SWAP CARDS
3001 LET F=0
3010 LET TEMP=H(T,D)
3020 LET H(T,D)=H(T+1,D)
3030 LET H(T+1,D)=TEMP
3040 RETURN
3100 REM STRAIGHT FLUSH
3101 GOSUB 3400
3110 IF X(D)=0 THEN RETURN
3111 LET X(D)=0
3120 GOSUB 3500
3150 IF X(D)=0 THEN RETURN
3160 LET X(D)=1
3170 LET G=12345
3180 RETURN
3200 REM FOURS
3201 FOR I=1 TO 2
3210 IF J(I)=J(I+1) AND J(I+2)=J
(I+3) AND J(I+1)=J(I+2) THEN GOT
O 3240
3220 NEXT I
3230 RETURN
3240 LET X(D)=2
3250 LET G=I*1000+(I+1)*100+(I+2
)*10+I+3
3260 RETURN
3300 REM FULL HOUSE
3301 GOSUB 3600
3310 IF X(D)=0 THEN RETURN
3311 LET X(D)=0
3320 GOSUB 3700
3321 LET X(D)=0
3330 IF TEMP=3 THEN LET X(D)=3
3331 IF TEMP=3 THEN LET G=12345
3340 RETURN
3400 REM FLUSH
3401 FOR I=1 TO 4
3402 LET T(I)=0
3403 NEXT I
3404 LET S4=0
3405 LET GS=0
3410 FOR I=1 TO 5
3420 LET K(I)=H(I,D)-J(I)*10
3430 LET T(K(I))=T(K(I))+1
3440 NEXT I
```

```
3450 FOR I=1 TO 4
3460 IF T(I)=5 THEN LET X(D)=4
3465 IF T(I)=4 THEN LET S4=I
3470 NEXT I
3471 IF X(D)=4 THEN LET G=12345
3472 IF S4=0 THEN RETURN
3480 FOR I=1 TO 5
3482 IF K(I)=S4 THEN LET GS=GS*1
0+I
3483 NEXT I
3484 RETURN
3500 REM STRAIGHT
3505 LET T4=0
3510 IF J(1)+4=J(2)+3 AND J(3)+2
=J(4)+1 AND J(5)=J(1)+4 AND J(2)
+3=J(3)+2 THEN LET X(D)=5
3520 IF J(5)=14 AND J(1)=2 AND J
(2)=3 AND J(3)=4 AND J(4)=5 THEN
 LET X(D)=5
3530 IF J(1)+3=J(2)+2 AND J(3)+1
3540 IF J(2)+3=J(3)+2 AND J(4)+1
=J(5) AND J(3)+2=J(4)+1 THEN LET
 T4=2345
```

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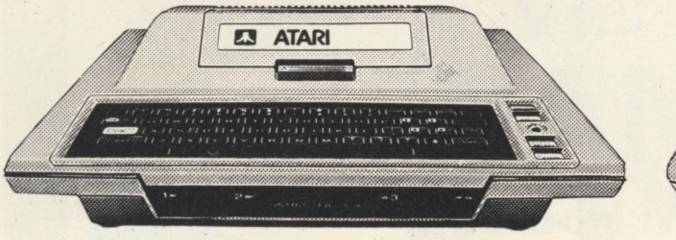

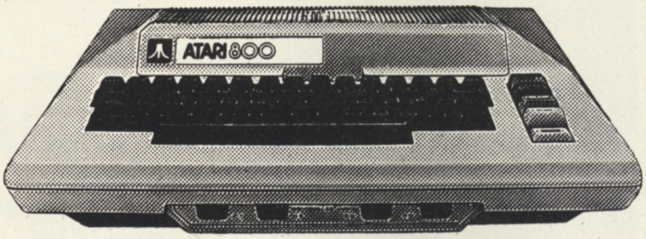

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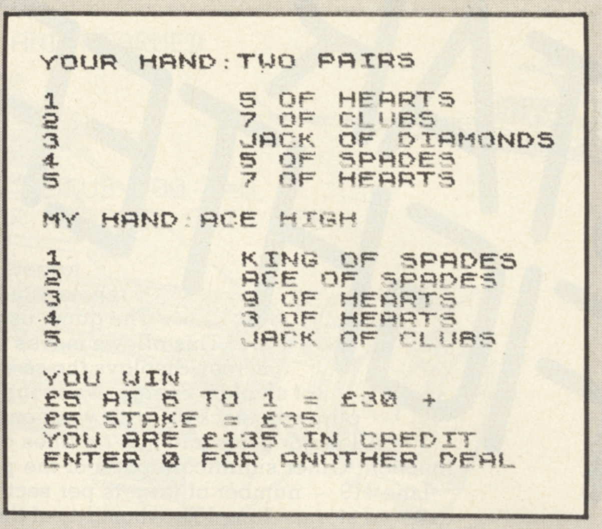
```
3550 IF J(5)=14 AND J(1)=2 AND J
(2)=3 AND J(3)=4 THEN LET T4=123
5
3560 IF X(D)=5 THEN LET G=12345
3570 RETURN
3600 REM THREES
3601 FOR I=1 TO 3
3610 IF J(I)=J(I+1) AND J(I)=J(I
+2) THEN GOTO 3640
3620 NEXT I
3630 RETURN
3640 LET X(D)=6
3650 LET G=I*100+(I+1)*10+I+2
3660 RETURN
3700 REM 2 PAIRS
3701 LET TEMP=0
3710 FOR I=1 TO 4
3720 IF J(I)=J(I+1) THEN LET TEM
P=TEMP+1
3725 IF J(I)=J(I+1) THEN LET G=G
*100+I*10+I+1
3730 NEXT I
3740 IF TEMP=2 THEN LET X(D)=7
3750 RETURN
3800 REM 1 PAIR
3801 LET G=0
3802 GOSUB 3700
3810 IF TEMP=1 THEN LET X(D)=8
3820 RETURN
3900 REM HIGH CARD
3910 LET X(D)=9
3920 LET G=5
3930 RETURN
4000 REM RETURN RANK
4010 LET R=INT (TEMP/10)
4020 LET S=TEMP-R*10
4030 LET R$=STR$ R
4040 IF R=14 THEN LET R$="ACE"
4050 IF R=13 THEN LET R$="KING"
4060 IF R=12 THEN LET R$="QUEEN"
4070 IF R=11 THEN LET R$="JACK"
4080 RETURN
4200 REM COMPUTE CARDS TO CHANGE
4210 LET M=0
4220 FOR I=1 TO 5
4230 IF Q$(I)<>"0" THEN LET M=M*
10+I
4240 NEXT I
4250 RETURN
6000 REM CHANGE CARDS B$
6005 LET M$=STR$ M
6010 LET B$=STR$ B
6020 FOR I=1 TO LEN STR$ B
6030 IF B$(I)>"5" OR B$(I)<"1" T
HEN LET F=0
6050 NEXT I
6055 IF F=0 THEN RETURN
6060 FOR I=1 TO LEN STR$ B
6070 LET N=N+1
6075 LET T=VAL M$(I)
6080 LET H(T,D)=C(N)*10+T
6090 LET TEMP=C(N)
6100 GOSUB 4000
6110 PRINT AT (VAL (B$(I))+V),10
;"                "
6120 PRINT AT (VAL (B$(I))+V),10
;R$;" OF ";S$(S)
6130 NEXT I
6140 RETURN
7000 REM SORT B
7010 LET B$=STR$ B
7020 LET U=B
7030 FOR F=1 TO 1
7040 FOR T=1 TO LEN STR$ U-1
7050 IF B$(T)>B$(T+1) THEN GOSUB
 7100
7060 NEXT T
7070 NEXT F
7080 LET B=VAL B$(1 TO LEN STR$
U)
7090 RETURN
7100 REM SWAP NUMBERS
7105 LET F=0
7110 LET T$=B$(T)
7120 LET B$(T)=B$(T+1)
7130 LET B$(T+1)=T$
7140 RETURN
```



```
YOUR HAND:TWO PAIRS

1          5 OF HEARTS
2          7 OF CLUBS
3          JACK OF DIAMONDS
4          5 OF SPADES
5          7 OF HEARTS

MY HAND:ACE HIGH

1          KING OF SPADES
2          ACE OF SPADES
3          9 OF HEARTS
4          3 OF HEARTS
5          JACK OF CLUBS

YOU WIN
£5 AT 6 TO 1 = £30 +
£5 STAKE = £35
YOU ARE £135 IN CREDIT
ENTER 0 FOR ANOTHER DEAL
```

STAR FIGHTER

MESSAGE TO STARFIGHTER: Your mission is to destroy enemy craft and bases in this sector. Our intelligence service has been unable to obtain exact locations of these targets but your shipboard computer will aid you in the search. Your ship is armed with neutron missiles and phaser weapons. Beware of asteroid storms in your sector. GOOD LUCK.

OK space fans — the object of this game is to search and destroy targets positioned randomly around the galaxy — which in this case is represented on the screen of a 40 column PET.

The game uses the whole screen for the galaxy, which is poked into position. This allows moves and action to be displayed as and when they happen. A second screen displays the co-ordinates of targets, starfighter and starbase, plus the condition of shields, energy, weapons and the number of targets available. The starfighter which you pilot can stock up with weapons and refuel at a friendly starbase.

All major parts and sub-routines of the program are prefixed by REM statements describing their function. Other significant parts of the program are:

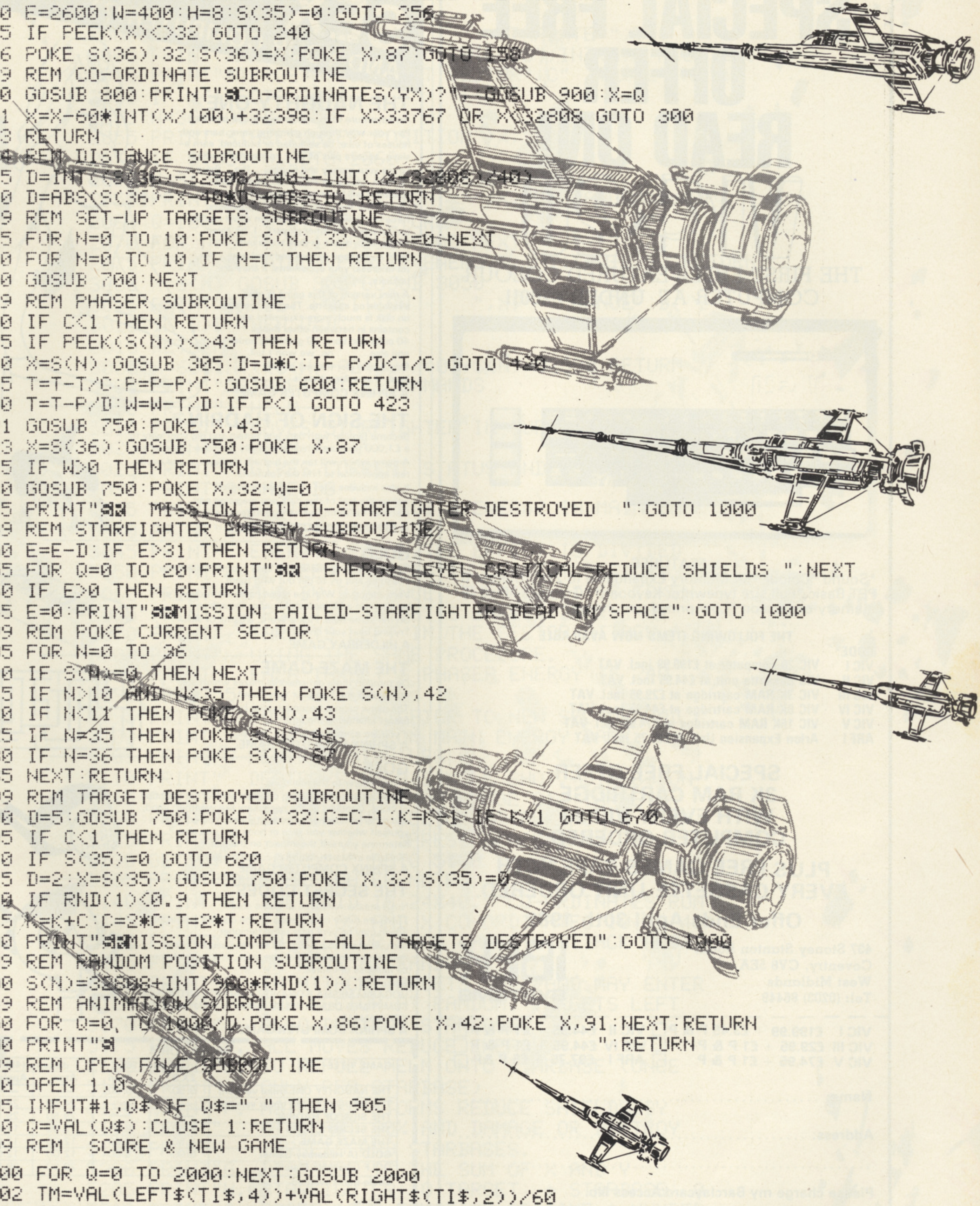
Line 119 — number of targets per sector. Line 125 — frequency of starbases. Line 142 — frequency of asteroid storms. Line 150 — hostility of the targets, this increases as the number of targets decrease. Line 158 — frequency with which the targets move and attack. Line 620 — frequency with which new targets enter the current sector during combat. Lines 899-910 — prevent the program crashing by loading the commands into a file.

RUNS ON A PET IN 6K

BY P. B. MORGAN

```
50 REM STARFIGHTER
55 REM P.B. MORGAN. NORTHVILLE. 120381
90 GOSUB 5000
99 REM INITIALISE VARIABLES
100 CLR:DIM S(36):K=55:E=2600:W=400:H=8
105 TI$="000000"
109 REM INITIALISE NEW SECTOR (5)
110 D=31:GOSUB 450
115 FOR N=0 TO 36:S(N)=0:NEXT
116 FOR N=11 TO 34:GOSUB 700:NEXT
119 C=INT(6*RND(1)):IF C>K THEN C=K
120 T=C*240:GOSUB 350
125 IF RND(1)<0.93 GOTO 135
130 N=35:GOSUB 700
135 N=36:GOSUB 700
140 PRINT"□":GOSUB 505
141 REM ASTEROID STORM
142 IF RND(1)<0.9 GOTO 150
144 PRINT"▒▒ WARNING: ASTEROID STORM-SHIELD DAMAGE "
146 FOR N=11 TO 34:GOSUB 700:POKE S(N),46:NEXT
148 P=2000:N=0:W=W*0.7:GOTO 155
149 REM TARGET ATTACK
150 P=0:N=INT(RND(1)*K*C/10)
155 FOR N=N TO 10:GOSUB 400:NEXT:GOSUB 345
158 GOSUB 505:IF RND(1)>0.7 GOTO 150
159 REM SELECT COMMANDS
160 GOSUB 800:PRINT"▒COMMAND?";:GOSUB 900
165 IF Q<1 OR Q>6 GOTO 160
170 ON Q GOTO 240,1900,220,230,110,200
199 REM NEUTRON MISSILES (6)
200 IF H<1 GOTO 1900
202 H=H-1:GOSUB 300:IF PEEK(X)=43 GOTO 206
204 PRINT"▒▒ TARGET MISSED-INCORRECT CO-ORDINATES ":GOTO 150
206 GOSUB 305:IF D<32 GOTO 210
208 PRINT"▒▒      TARGET MISSED-OUT OF RANGE       ":GOTO 150
210 T=T-T/C:GOSUB 600:P=0:N=0:GOTO 155
219 REM SHIELD CONTROL (3)
220 GOSUB 800:E=E+W:PRINT"▒ENERGY";INT(E),"SHIELDS?";:GOSUB 900
223 W=Q:E=E-W:IF E<1 GOTO 220
225 GOTO 160
229 REM PHASER CONTROL (4)
230 GOSUB 800:PRINT"▒ENERGY";INT(E),"PHASERS?";:GOSUB 900
233 P=Q:IF E<P OR P<0 GOTO 230
235 E=E-P:N=0:GOTO 155
```

```
239 REM HELM  CONTROL (1)
240 GOSUB 300:GOSUB 305:GOSUB 450
245 IF PEEK(X)<>48 GOTO 255
246 PRINT"■■STARFIGHTER DOCKED-REFUELED AND REARMED
250 E=2600:W=400:H=8:S(35)=0:GOTO 256
255 IF PEEK(X)<>32 GOTO 240
256 POKE S(36),32:S(36)=X:POKE X,87:GOTO 150
299 REM CO-ORDINATE SUBROUTINE
300 GOSUB 800:PRINT"■CO-ORDINATES(YX)?";:GOSUB 900:X=Q
301 X=X-60*INT(X/100)+32398:IF X>33767 OR X<32808 GOTO 300
303 RETURN
304 REM DISTANCE SUBROUTINE
305 D=INT((S(36)-32808)/40)-INT((X-32808)/40)
310 D=ABS(S(36)-X-40*D)+ABS(D):RETURN
339 REM SET-UP TARGETS SUBROUTINE
345 FOR N=0 TO 10:POKE S(N),32:S(N)=0:NEXT
350 FOR N=0 TO 10:IF N=C THEN RETURN
360 GOSUB 700:NEXT
399 REM PHASER SUBROUTINE
400 IF C<1 THEN RETURN
405 IF PEEK(S(N))<>43 THEN RETURN
410 X=S(N):GOSUB 305:D=D*C:IF P/D<T/C GOTO 420
415 T=T-T/C:P=P-P/C:GOSUB 600:RETURN
420 T=T-P/D:W=W-T/D:IF P<1 GOTO 423
421 GOSUB 750:POKE X,43
423 X=S(36):GOSUB 750:POKE X,87
425 IF W>0 THEN RETURN
430 GOSUB 750:POKE X,32:W=0
435 PRINT"■■  MISSION FAILED-STARFIGHTER DESTROYED  ":GOTO 1000
449 REM STARFIGHTER ENERGY SUBROUTINE
450 E=E-D:IF E>31 THEN RETURN
455 FOR Q=0 TO 20:PRINT"■■  ENERGY LEVEL CRITICAL-REDUCE SHIELDS ":NEXT
460 IF E>0 THEN RETURN
465 E=0:PRINT"■■MISSION FAILED-STARFIGHTER DEAD IN SPACE":GOTO 1000
499 REM POKE CURRENT SECTOR
505 FOR N=0 TO 36
510 IF S(N)=0 THEN NEXT
515 IF N>10 AND N<35 THEN POKE S(N),42
520 IF N<11 THEN POKE S(N),43
525 IF N=35 THEN POKE S(N),48
530 IF N=36 THEN POKE S(N),87
535 NEXT:RETURN
599 REM TARGET DESTROYED SUBROUTINE
600 D=5:GOSUB 750:POKE X,32:C=C-1:K=K-1:IF K<1 GOTO 670
605 IF C<1 THEN RETURN
610 IF S(35)=0 GOTO 620
615 D=2:X=S(35):GOSUB 750:POKE X,32:S(35)=0
620 IF RND(1)<0.9 THEN RETURN
625 K=K+C:C=2*C:T=2*T:RETURN
670 PRINT"■■MISSION COMPLETE-ALL TARGETS DESTROYED":GOTO 1000
699 REM RANDOM POSITION SUBROUTINE
700 S(N)=32808+INT(960*RND(1)):RETURN
749 REM ANIMATION SUBROUTINE
750 FOR Q=0 TO 1000/D:POKE X,86:POKE X,42:POKE X,91:NEXT:RETURN
800 PRINT"■                                    ":RETURN
899 REM OPEN FILE SUBROUTINE
900 OPEN 1,0
905 INPUT#1,Q$:IF Q$=" " THEN 905
910 Q=VAL(Q$):CLOSE 1:RETURN
999 REM  SCORE & NEW GAME
1000 FOR Q=0 TO 2000:NEXT:GOSUB 2000
1002 TM=VAL(LEFT$(TI$,4))+VAL(RIGHT$(TI$,2))/60
1004 PRINT"■■YOU SCORED";INT((5-SQR(K))*(30-TM));"POINTS
1005 PRINT"■■    ■PRESS ANY KEY FOR ANOTHER GAME"
1010 GET Q$:IF Q$="" THEN 1010
1015 GOTO 90
1899 REM SCAN SUBROUTINE (2)
1900 GOSUB 2000              :PRINT"■■■PRESS SPACE BAR OR 'I' FOR INSTRUCTIONS"
1905 GET Q$:IF Q$=" " GOTO 1920
1910 IF Q$<>"I" GOTO 1905
```



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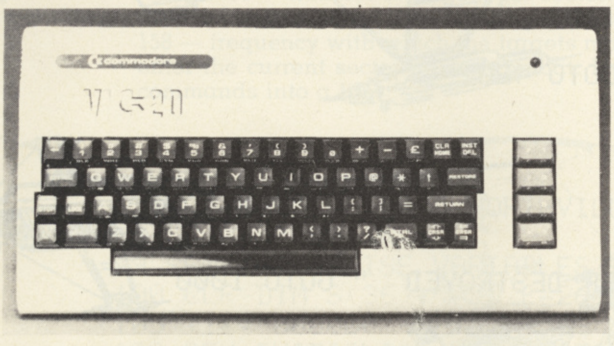

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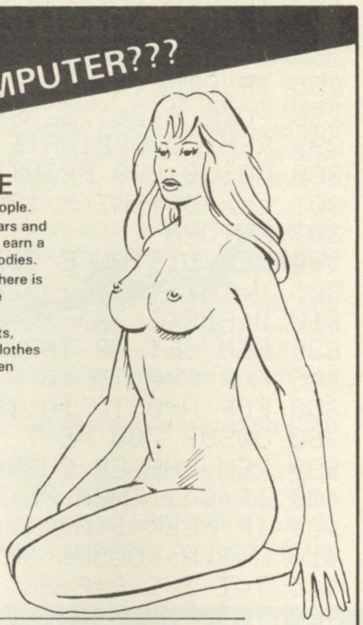

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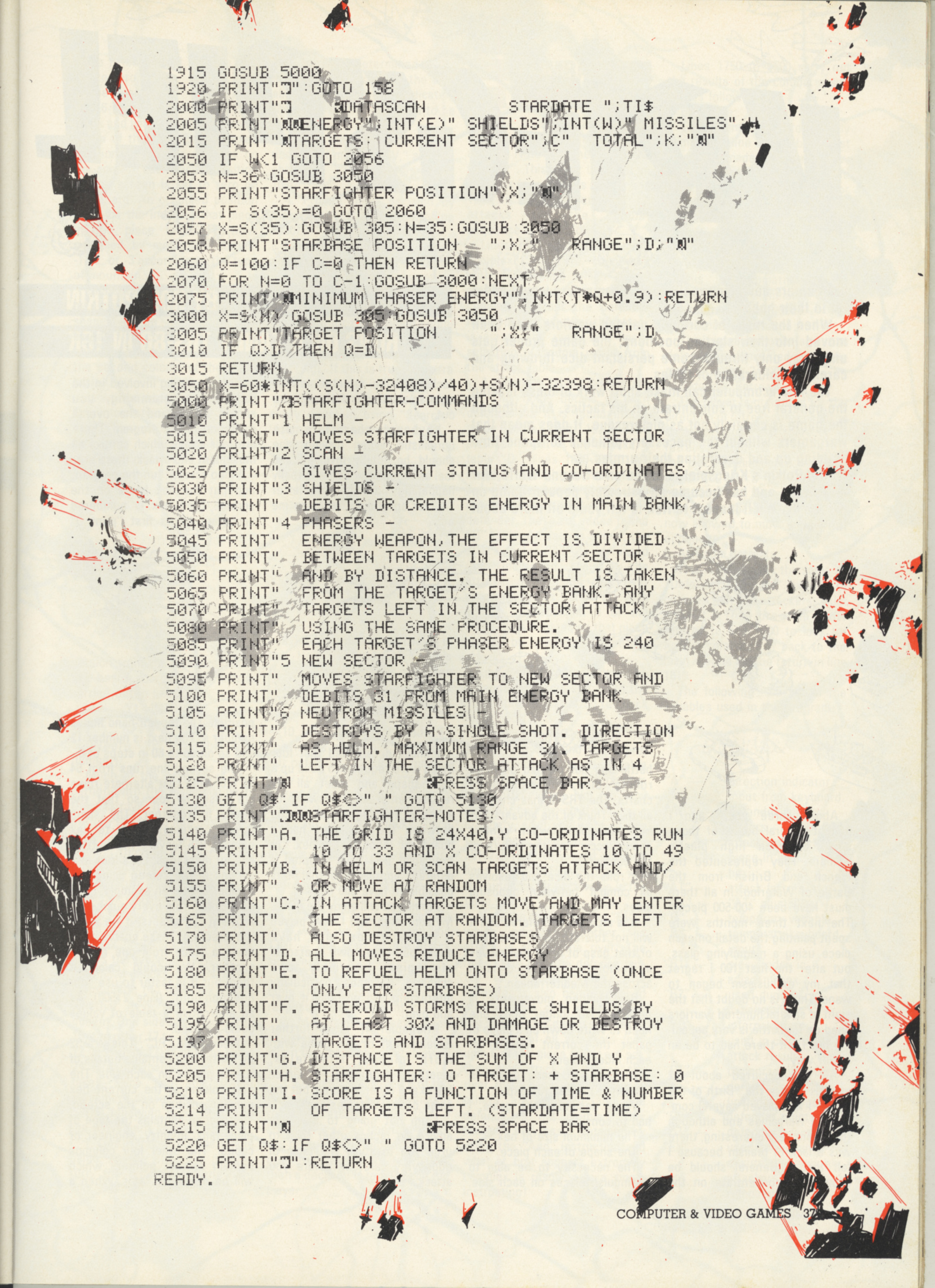


```
 1915 GOSUB 5000
 1920 PRINT"ℷ":GOTO 158
 2000 PRINT"ℷ     ▒DATASCAN          STARDATE ";TI$
 2005 PRINT"■■ENERGY";INT(E)" SHIELDS";INT(W)" MISSILES";M
 2015 PRINT"■TARGETS: CURRENT SECTOR";C"  TOTAL";K;"■"
 2050 IF W<1 GOTO 2056
 2053 N=36:GOSUB 3050
 2055 PRINT"STARFIGHTER POSITION";X;"■"
 2056 IF S(35)=0 GOTO 2060
 2057 X=S(35):GOSUB 305:N=35:GOSUB 3050
 2058 PRINT"STARBASE POSITION   ";X;"   RANGE";D;"■"
 2060 Q=100:IF C=0 THEN RETURN
 2070 FOR N=0 TO C-1:GOSUB 3000:NEXT
 2075 PRINT"■MINIMUM PHASER ENERGY";INT(T*Q+0.9):RETURN
 3000 X=S(N):GOSUB 305:GOSUB 3050
 3005 PRINT"TARGET POSITION        ";X;"   RANGE";D
 3010 IF Q>D THEN Q=D
 3015 RETURN
 3050 X=60*INT((S(N)-32408)/40)+S(N)-32398:RETURN
 5000 PRINT"ℷSTARFIGHTER-COMMANDS
 5010 PRINT"1 HELM -
 5015 PRINT"  MOVES STARFIGHTER IN CURRENT SECTOR
 5020 PRINT"2 SCAN -
 5025 PRINT"  GIVES CURRENT STATUS AND CO-ORDINATES
 5030 PRINT"3 SHIELDS -
 5035 PRINT"  DEBITS OR CREDITS ENERGY IN MAIN BANK
 5040 PRINT"4 PHASERS -
 5045 PRINT"  ENERGY WEAPON,THE EFFECT IS DIVIDED
 5050 PRINT"  BETWEEN TARGETS IN CURRENT SECTOR
 5060 PRINT"  AND BY DISTANCE. THE RESULT IS TAKEN
 5065 PRINT"  FROM THE TARGET'S ENERGY BANK. ANY
 5070 PRINT"  TARGETS LEFT IN THE SECTOR ATTACK
 5080 PRINT"  USING THE SAME PROCEDURE.
 5085 PRINT"  EACH TARGET'S PHASER ENERGY IS 240
 5090 PRINT"5 NEW SECTOR -
 5095 PRINT"  MOVES STARFIGHTER TO NEW SECTOR AND
 5100 PRINT"  DEBITS 31 FROM MAIN ENERGY BANK
 5105 PRINT"6 NEUTRON MISSILES -
 5110 PRINT"  DESTROYS BY A SINGLE SHOT. DIRECTION
 5115 PRINT"  AS HELM. MAXIMUM RANGE 31. TARGETS
 5120 PRINT"  LEFT IN THE SECTOR ATTACK AS IN 4
 5125 PRINT"■              ▒PRESS SPACE BAR
 5130 GET Q$:IF Q$<>" " GOTO 5130
 5135 PRINT"ℷ■■STARFIGHTER-NOTES
 5140 PRINT"A. THE GRID IS 24X40.Y CO-ORDINATES RUN
 5145 PRINT"   10 TO 33 AND X CO-ORDINATES 10 TO 49
 5150 PRINT"B. IN HELM OR SCAN TARGETS ATTACK AND/
 5155 PRINT"   OR MOVE AT RANDOM
 5160 PRINT"C. IN ATTACK TARGETS MOVE AND MAY ENTER
 5165 PRINT"   THE SECTOR AT RANDOM. TARGETS LEFT
 5170 PRINT"   ALSO DESTROY STARBASES
 5175 PRINT"D. ALL MOVES REDUCE ENERGY
 5180 PRINT"E. TO REFUEL HELM ONTO STARBASE (ONCE
 5185 PRINT"   ONLY PER STARBASE)
 5190 PRINT"F. ASTEROID STORMS REDUCE SHIELDS BY
 5195 PRINT"   AT LEAST 30% AND DAMAGE OR DESTROY
 5197 PRINT"   TARGETS AND STARBASES.
 5200 PRINT"G. DISTANCE IS THE SUM OF X AND Y
 5205 PRINT"H. STARFIGHTER: O TARGET: + STARBASE: 0
 5210 PRINT"I. SCORE IS A FUNCTION OF TIME & NUMBER
 5214 PRINT"   OF TARGETS LEFT. (STARDATE=TIME)
 5215 PRINT"■              ▒PRESS SPACE BAR
 5220 GET Q$:IF Q$<>" " GOTO 5220
 5225 PRINT"ℷ":RETURN
READY.
```

KRIEGSPIEL

Wargamers have long realised that computers would add a lot to their hobby.

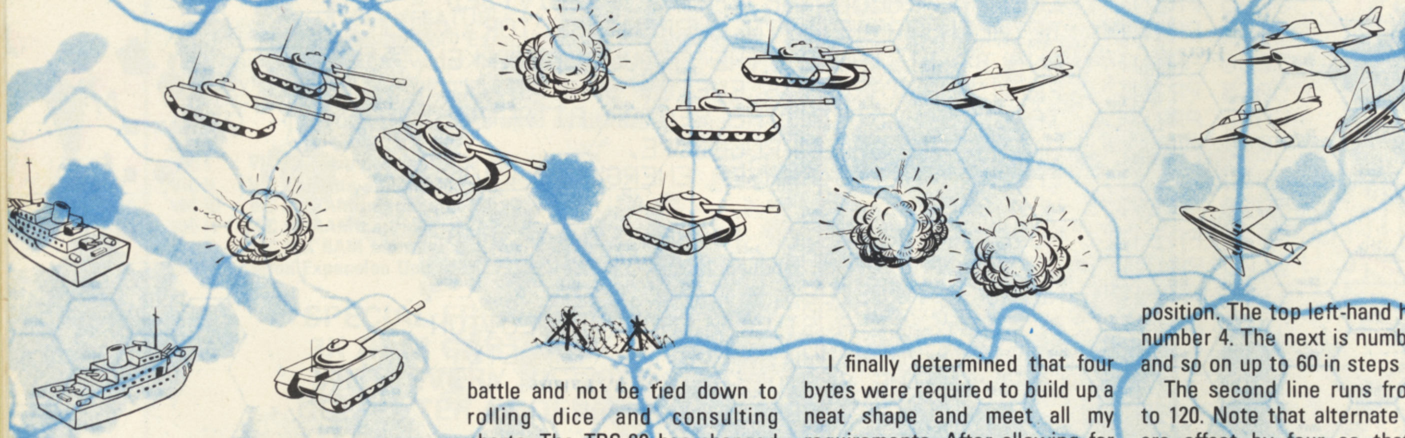
When the ranks of carefully painted warriors have been moved into their starting positions, the game proper gets underway only through some persistant dice throwing and careful consideration of tables.

The microcomputer can make short work of these leaving the general free to concentrate on his tactics. And although the game is certainly not as picturesque, it does mean that wargamers without the necessary patience to spend time building up and decorating their armies.

Ron Potkin's Kriegspiel is based on a Second World War tank battle and has become an extremely popular game on the Tandy. We'll leave it to Ron to tell you a bit more about the game.

BY RON POTKIN

RUNS ON A TANDY TRS-80 IN 16K



About three years ago I bought several boxes of those small one-inch high plastic soldiers. They represented the French and British from the Battle of Waterloo. In all there must have been 400-500 pieces. The next three months were spent painting the detail on each piece using a magnifying glass, but after the first 100 I regret that my enthusiasm began to wane. There is no doubt that the sight of several hundred warriors lined up for battle is very appealing but I felt there had to be an easier way.

All this occurred about 12 months before the "Birth of the Byte." I had played several commercial wargames and although they were very interesting, there was a lack of realism because I felt that a General should be allowed to concentrate on the battle and not be tied down to rolling dice and consulting charts. The TRS-80 has changed all that. Think of the advantages:

It determines when conflict should occur and the nature of the conflict.

It rolls the dice and resolves all combat between opposing sides.

It is an impartial referee and it will not tolerate heavy breathing or that gasp of relief that moves a complete armour division across the Mediterranean.

Real hidden movements is possible. No longer does one need to write down on a piece of paper the current location of each hidden piece.

It was with these points in mind that I wrote Kriegspiel.

While designing the game. I had to consider:

The minimum size of hex.

The shape of each piece.

The necessity to be able to distinguish pieces on each side. Each must be oriented left or right so squares and oblongs are out.

Keyboard characters are unrealistic. When playing, one should be totally involved and feel as though the battle is really happening: I am afraid the letter "A" for army does not turn me on.

I finally determined that four bytes were required to build up a neat shape and meet all my requirements. After allowing for a line of messages and spaces between the pieces. I had a board of about 120 hex. In Kreigspiel II, I have adopted a different approach so that it is possible to have 500 hex.

I think you will enjoy the game. My son Leigh, and I have played it many times and have developed our own personal strategies. Invariably, one scenario becomes particularly interesting and we play it over and over.

Kriegspiel II is a further development of this game with more pieces, minefields, weather, recruiting, a larger board and other features, but the same basic strategies apply.

I am not going to give any advice on tactics other than to urge you to study the table of odds very carefully before you attack.

Before getting involved in the detailed programming, you should understand the overall operation of the program. There are four arrays which control all movement and attack, these are:

Video screen: run the program and put the hex board on the screen. Each hex is numbered according to its first "print 0" position. The top left-hand hex is number 4. The next is number 12 and so on up to 60 in steps of 8.

The second line runs from 64 to 120. Note that alternate rows are offset by four so that the hexes fit together. The same format continues down to hex number 956 leaving the bottom line for messages. Let's look at a section of the screen using hex number 400 as an example. Now deduct 400 from every number to arrive at the offsets. If we know the direction. These enable us to move a piece from one hex to another. We could calculate them but it is faster to use "on-direction-goto" (Line 21500). As an alternative a table of values could be used.

Piece table "PC": This is a 32 by 6 array and contains details of the 16 pieces on each side. The first column is the current hex number position on the screen. The second contains the type of piece-tank, infantry, engineer or capital. The other four columns contain combat pointers which will be described later. When a piece is eliminated, column 1 is set to zero.

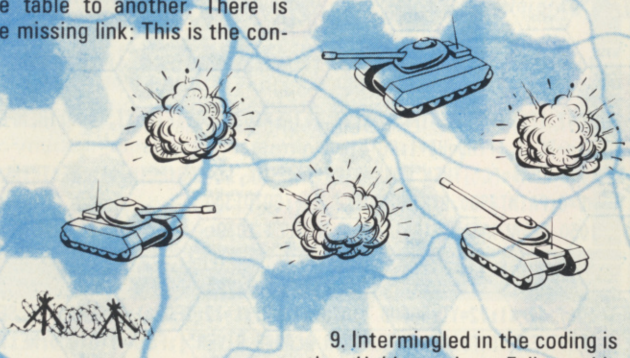
The board "BO": This is a 16 by 16 array, including the zero index and is an internal representation of the map. Each indexed position is equal to one hex on the screen. Each vacant position on the screen is set to zero on the board. An occupied position contains the index of that piece in the piece table. Positions occupied by mountains contain -1, -2, or -3 according to the type of mountain.

Characters "PC$". This is a 7 by 4 character string holding the shapes to be printed on the screen. The correct character is obtained by means of its index in the second column of the piece table.

It will be apparent that, using the information in each of the arrays, we can easily move from one table to another. There is one missing link: This is the conversion from the hex number to the board coordinates which is carried out in line 2100:

Y1=INT(P/64)
X1=(P-64·Y1)/4

(Where "P" is the hex number).



Much of the program is concerned with the manipulation of these arrays. It is in motion by putting the initial hex position of each piece in each array and then running through the piece table prompting for a decision on each piece in turn. Assuming the piece is on hex 400 and you type direction 6, the program calculates the board coordinates, checks that hex 352 is vacant and, if it is, moves the piece.

It now checks the six hexes surrounding the new hex to see whether it is next to an opponent. One side has indices 1 to 16; the other 17 to 32: So if piece 12 (less than 17) is next to piece 24 (greater than 16), an attack takes place and any further movement ceases.

The following is an outline of the movement sequence:

1. Line 200 controls the whole game. At the end of a player's turn, the program returns here and changes sides.

2. Turns are determined by "5" in line 1000 which sets the variable 1, to either 1 or 17 indicating the index of the first piece to be moved.

3. Gets the hex number FL, the number of moves "MV," and the character "FL$." (lines 1010, 1020).

4. Prompt for a decision by flickering "FL$" and "MV." (line 1030).

5. If the input is a number, check if valid and either move the piece or continue prompting. (lines 1050-1210).

6. Checks during movement (line 1065) for the winning condition.

7. Line 1075 checks "river crossing." If this is true, an extra movement factor is deducted.

8. Line 1182 checks one hex in every direction using "Search," looking for an opponent.

9. Intermingled in the coding is the Hold routine. Follow this through watching the variables "HD," "K1," and "HL" in lines 1000, 1010, 1017/8, 1047/8, and 1218.

10. The "C," "S," and "F" commands are easier to follow, but note that "C" jumps immediately to line 1300, whereas "F" carries out a full check of pieces that have not been prompted to check for possible attacks. Since this involves checking six hexes for every piece, it is a slow process and therefore, if it can be seen that no pieces are adjacent, it is better to use "C."

Let us take stock of what we have when we finally reach line 1300 — the start of the attack sequence:

1. The board, video, and piece table have been updated in respect to all movement.

2. Mountains will have been adjusted on the board and video when they have been eaten away by the engineer.

3. Columns 3, 4, 5, and 6 of the piece table contain information regarding attacks. Note that if column 4 is set to one that attack will be automatic and requires no prompting. If it is greater than 1, then a decision is required by the player.

COMBAT SEQUENCE

Lines 1305 to 1500 are a prompting routine and settle all attacks. Note that the use of the flag "22". This is set to one if an attack is found. If it is zero at line 1550, it means there are no attacks and the combat sequence is finished.

Lines 1600 to 1745 are more complex. They are concerned with determining which pieces are involved in each individual combat, whether the defender has support; whether the attack is across the river; and finally selecting a random result from the attack table.

A defender table "DR," is set up. This holds details of each defender as it is found in the piece table (line 1620). The attacker is put in the attacker's table "Q" (lines 1680-1690). We now go through the rest of the piece table searching for any other pieces attacking the same defender. These are added to the "Q" table. As each is added, the attack factor "AT" is increased (and increased again if the attacker is a tank), the river crossing flag is "and" ED with "DR(3)" and column 3 of the piece table negated so that piece cannot be involved in another attack.

Lines 1700-1710 calculate the defender's factors and go to the subroutine at 4000/4200 to check for support.

Lines 1720-1740 calculate the attack ratio and find the appropriate column in the attack table from which it selects a random result. If you are like me, you probably find typing the rules is drudgery, so if you want to see the attack table, look at lines 20162-20167. Now read through lines 40192-40415 which tell you the outcome for each value in the table.

Note the use of the flag "RV"," which indicates whether the attack is across the river. The rules state that the defence factor is doubled unless the defender is also being attacked on the same side, of the river. Put simply, this means that if the river flags of all attackers (column 6 of the piece table) are set, then the attack is across the river. If any flag is not set then all others are nullified and the defence is not doubled. This result is very easily obtained by using the "And" instruction and what at first appears extremely complex is resolved in a single instruction!

Lines 1750 to 2500 carry out the results of the combat result "R" as follows:

1. Exchange:

The defender is automatically eliminated (line 24000), but a test must be made to check how many factors the attacker had (line 1706/7). If they were less or equal to the defender's, then elimination is automatic. Otherwise the attacker is prompted for the pieces to be eliminated.

2. Attacker Eliminated:

This is automatic and all attackers are eliminated using the routine at line 25000.

3. Defender Eliminated:

This is automatic and the defender is eliminated using the routine at line 24000.

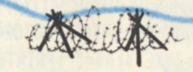
4. Defender Retreats:

The player is prompted for the direction of retreat and a check is made for legality. If there is no retreat then an "E" is typed and the piece is eliminated. The variable 'RD" is a count of the number of hexes moved. Remember that the defender is now allowed to move next to an opponent.

5. Attacker Retreats:

This is essentially the same as "Defender Retreats" except, of course, that all attackers must retreat. The program now returns to line 1600 to look for further combat. Exit back to the main routine via the return in line 1610.

The following is a list of the variables used in the program:

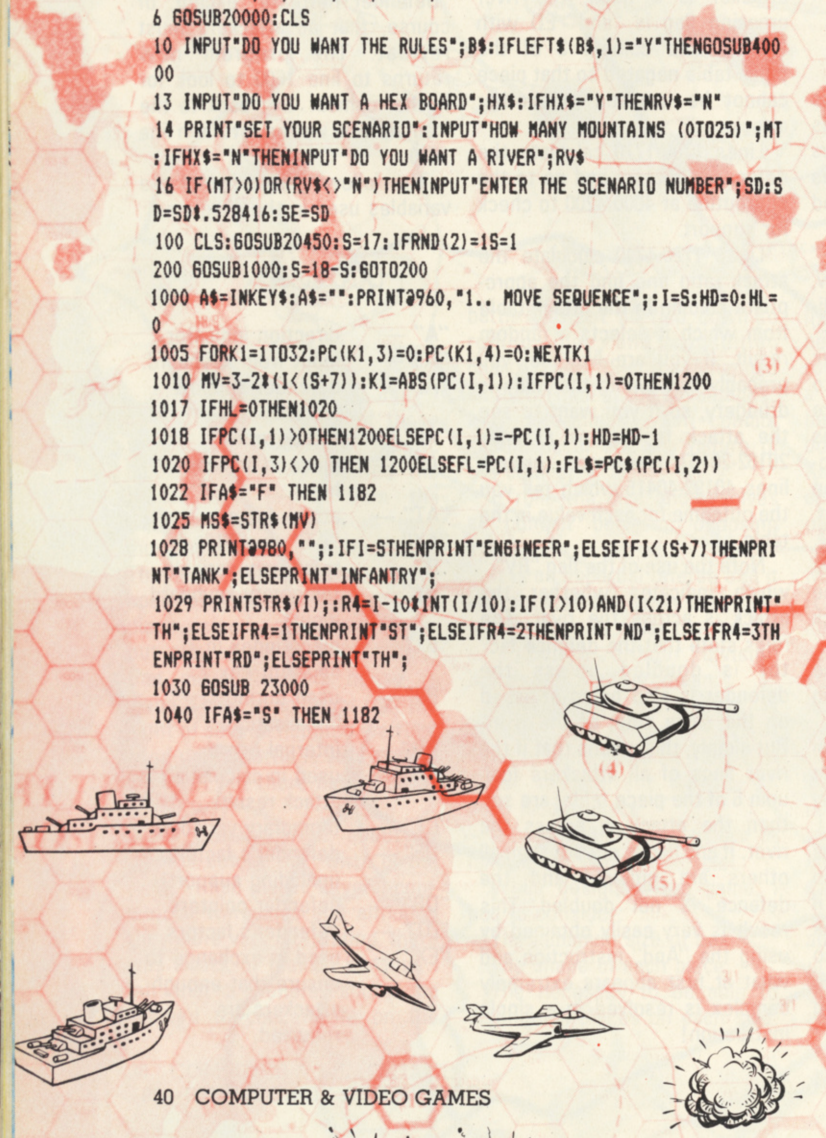


"A" — direction indicator.
"A$ — input from keyboard.
"AD" — defender support factors.
"AF" — attack ratio.
"AJ" — piece in adjacent hex.
"AT" — attack factors.
"AX" — "AT" plus 50%.
"B" — temporary variable.
"B$" — temporary keyboard input.
"B1" — piece index in adjacent hex.
"B2" — used during initialisation.
"BD" — internal board.
"CL" — used in calculating attack result.
"CT" — temporary variable.
"DF" — defender's factors (including support).
"DR" — defender pointers.
"DT" — defender's factors.
"EX" — used in exchange to ensure that enough attackers are removed.

“F2” —	attack flag.
“F3” —	flag used when looking for support.
“FL” —	current hex number.
“FL$” —	current piece character.
“HA” —	pointer to current attacker when looking for defenders in combat sequence.
“HB” —	maintains count of attackers in table “Q”.
“HC” —	temporary count.
“HD” —	“hold” variable.
“HL” —	“hold” variable.
“HX$” —	hex board request.
“I” —	index to piece being moved.
“J” —	temporary variable.
“K” —	temporary variable.
“K1” —	“hold” variable.
“KP” —	used to save pointer.
“LN” —	used to create river.
“MS” —	used for prompt messages.
“MT” —	number of mountains.
“MV” —	moves left.
“P” —	new hex number.
“PC” —	piece table.
“PC$” —	piece characters.
“Q” —	table of attackers.
“R1” —	used in random number generator.
“R1$” —	hex board.
“R2$” —	hex board.
“R3$” —	hex board.
“R3” —	used in random number generator.
“R4$” —	hex board.
“RD” —	retreat count.
“RN” —	random number.
“RT” —	attack result.
“RV” —	river crossing flag.
“S” —	whose turn is it?
“SD” —	random number seed.
“SE” —	holds “SD.” This is necessary since the number of mountains requested could upset the shape of the river. The river can’t be placed first because it would be destroyed by the mountains.
“SR” —	used to create river.
“TB” —	table of attack outcomes.
“X” —	coordinates to river graphics to check for river.
“X1” —	hex number to board coordinates.
“X2” —	save “X1.”
“Y” —	see “X.”
“Y1” —	see “Y1.”
“Y2” —	see “X2.”
“Z” —	hex offset.
“ZZ” —	attack flag.

I hope you will enjoy this program and, maybe, with the help of this explanation, find ways to improve it. I adopted most of the ideas in this game in Kriegspiel II, but the programming methods changed in several instances. For example, I found that many routines (particularly “search” and “river crossing”) could be simplified by using tables of data. Probably the best change I made however was to surround the board with a boarder of 99s. This greatly simplified checking for movement off the edge of the board.

```
1 CLS:PRINT@143,"****************************************";:
     PRINT@207,"*            KRIEGSPIEL              *":
    :PRINT@271,"*   A WARGAME FOR TWO PLAYERS        *"
    :PRINT@335,"*          BY RON POTKIN             *"
2     PRINT@399,"****************************************"
3 CLEAR280:DEFINTA-Q,T-Z:RANDOM
5 DIMPC(32,6),TB(6,11),BD(15,15)
6 GOSUB20000:CLS
10 INPUT"DO YOU WANT THE RULES";B$:IFLEFT$(B$,1)="Y"THENGOSUB400
00
13 INPUT"DO YOU WANT A HEX BOARD";HX$:IFHX$="Y"THENRV$="N"
14 PRINT"SET YOUR SCENARIO":INPUT"HOW MANY MOUNTAINS (0TO25)";MT
:IFHX$="N"THENINPUT"DO YOU WANT A RIVER";RV$
16 IF(MT>0)OR(RV$<>"N")THENINPUT"ENTER THE SCENARIO NUMBER";SD:S
D=SD*.528416:SE=SD
100 CLS:GOSUB20450:S=17:IFRND(2)=1S=1
200 GOSUB1000:S=18-S:GOTO200
1000 A$=INKEY$:A$="":PRINT@960,"1.. MOVE SEQUENCE";:I=S:HD=0:HL=
0
1005 FORK1=1TO32:PC(K1,3)=0:PC(K1,4)=0:NEXTK1
1010 MV=3-2*(I<(S+7)):K1=ABS(PC(I,1)):IFPC(I,1)=0THEN1200
1017 IFHL=0THEN1020
1018 IFPC(I,1)>0THEN1200ELSEPC(I,1)=-PC(I,1):HD=HD-1
1020 IFPC(I,3)<>0 THEN 1200ELSEFL=PC(I,1):FL$=PC$(PC(I,2))
1022 IFA$="F" THEN 1182
1025 MS$=STR$(MV)
1028 PRINT@980,"";:IFI=STHENPRINT"ENGINEER";ELSEIFI<(S+7)THENPRI
NT"TANK";ELSEPRINT"INFANTRY";
1029 PRINTSTR$(I);:R4=I-10*INT(I/10):IF(I>10)AND(I<21)THENPRINT"
TH";ELSEIFR4=1THENPRINT"ST";ELSEIFR4=2THENPRINT"ND";ELSEIFR4=3TH
ENPRINT"RD";ELSEPRINT"TH";
1030 GOSUB 23000
1040 IFA$="S" THEN 1182
```



```
1045 IFA$="F" THENFORK=STOS+14:PC(K,1)=ABS(PC(K,1)):NEXTK:HL=0:H
D=0:GOTO 1182
1047 IFA$="H"THENIFK1<>PC(I,1)THEN1030ELSEIF(PC(I,1)>0)THENPC(I,
1)=-PC(I,1):HD=HD+1:GOTO1200
1048 IFA$="C" THEN FORK=STOS+14:PC(K,1)=ABS(PC(K,1)):NEXTK:HL=0:
HD=0:PRINT@980,STRING$(12," ");:GOTO1300
1050 A=VAL(A$):IF(A<1)OR(A>7) THEN 1030
1060 GOSUB 21500
1065 IF((S=17)AND(P=200))OR((S=1)AND(P=820))THEN30000
1067 X2=X1:Y2=Y1:GOSUB 31075:Y1=Y2:X1=X2:IFAJ<>-2THEN1070ELSE
IFRVTHENPRINT@1000,"MOUNTAIN ACROSS RIVER";:FORK=1TO1000:NEXTK:P
RINT@1000,STRING$(22," ");:GOTO 1030
1068 MV=1:BD(Y1,X1)=BD(Y1,X1)+1:IFBD(Y1,X1)<>0THENPRINT@P,MT$(-B
D(Y1,X1));:GOTO1182ELSEGOSUB21010:IFY>1THENRESET(X+2,Y-2):RESET(
X+5,Y-2)
1069 PRINT@P,"    ";:RESET(X+2,Y+2):RESET(X+5,Y+2):GOTO 1182
1070 IFAJ<>0 THEN 1030
1075 IFMV=1ANDRVTHEN1030ELSEMV=MV+(RV=1)
1170 PRINT@FL,"    ";:PRINT@P,FL$;
1175 GOSUB 21000
1180 PC(I,1)=P:BD(Y1,X1)=I:P=FL:GOSUB21000:BD(Y1,X1)=0:FL=FL+Z
1182 FORA=1TO6:GOSUB21500:GOSUB22000:NEXTA
1189 IFA$="S"ORA$="F"THEN1200
1190 MV=MV-1:IFMVTHEN1020
1200 PRINT@980,STRING$(15," ");:I=I+1:IFI<(S+15) THEN 1010
1210 IFHD>0THENHL=1:I=S:GOTO1010
1300 PRINT@960,"2.COMBAT SEQUENCE";STRING$(45," ");
1305 ZZ=0
1310 FORI=STOS+14
1315 IF(PC(I,3)=0)THEN1500
1318 ZZ=1
1320 IF(PC(I,4)=1)THEN1500ELSEFL=PC(I,1):FL$=PC$(PC(I,2))
1325 MS$="AT"
1330 GOSUB23000
1340 A=VAL(A$):IFA=(A<1)OR(A>7)THEN1330
1350 GOSUB21500
1370 GOSUB22000
1380 IFF2=0GOTO1330
1500 NEXTI
1550 IFZZ=0RETURN
1600 AT=0:HA=S:HB=0
1610 IFPC(HA,3)<=0THENHA=HA+1:IFHA>(S+14)THENRETURNELSEGOTO1610
1620 DR(1)=PC(HA,3):DR(2)=PC(HA,5):DR(3)=PC(HA,6)
1630 GOSUB1680
1640 HA=HA+1:IFHA>(S+14)THEN1700
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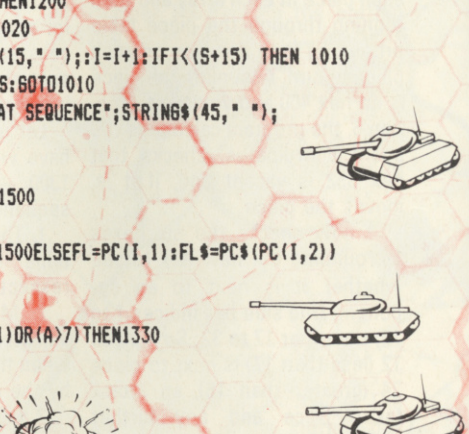

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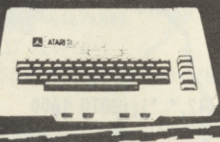

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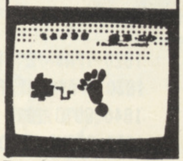

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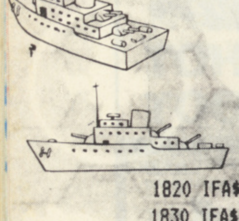
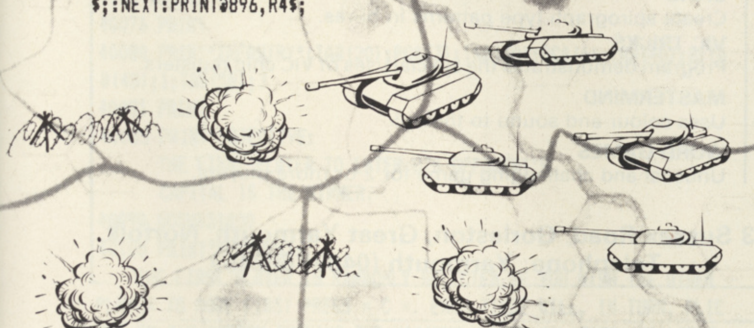
```
1650 IFPC(HA,3)<>DR(1)THEN1640
1660 GOSUB1680
1670 GOTO1640
1680 HB=HB+1:Q(HB,1)=PC(HA,1):Q(HB,2)=HA:
AT=AT+1:DR(3)=DR(3)ANDPC(HA,6):PC(HA,3)=-PC(HA,3)
1685 IF(PC(HA,2)=2)OR(PC(HA,2)=5)THENAT=AT+1
1690 RETURN
1700 DT=1
1710 IF(PC(DR(2),2)=2)OR(PC(DR(2),2)=5) THEN DT=DT+1
1712 GOSUB4000
1715 IFDR(3)<>0 THEN DT=DT+DT
1720 AX=INT(AT+.5*AT):IFAX>(DT+AD) THEN AF=INT(AX/(DT+AD)):DF=1:
CL=AF+5:GOTO 1740
1730 DF=INT((DT+AD)/AX):AF=1:CL=7-DF
1740 IFAF>6 THEN RT=1ELSEIFDF>6 THEN RT=-1ELSERT=TB(RND(6),CL)
1745 PRINT@980,"ATTACKER";AX;"DEFENDER";DT+AD;
1750 IFRT<>0 THEN 1900
1755 PRINT" EXCHANGE";
1770 GOSUB 24000
1780 HA=1
1785 IFHB=1 THEN GOSUB 25000:GOTO 1900
1786 K=0:FORHA=1TOHB:K=K+1:IF(PC(Q(HA,2),2)=2)OR(PC(Q(HA,2),2)=5
)THENK=K+1
1787 NEXTHA:IFK<=DTTHENFORHA=1TOHB:GOSUB25000:NEXTHA:GOTO1900
1790 HA=1:EX=DT:CT=HB
1795 IFQ(HA,1)=0THEN1880
1800 MS$="EL":FL=PC(Q(HA,2),1):FL$=PC$(PC(Q(HA,2),2))
1810 GOSUB 23000
```



```
1820 IFA$="E" THEN 1850
1830 IFA$="N" THEN 1880
1840 GOTO 1810
1850 GOSUB 25000
1860 Q(HA,1)=0
1865 CT=CT-1:IFCT=0 THEN 1900
1870 IFEX<=0 THEN 1900
1880 HA=HA+1:IFHA<(HB+1) THEN 1795
1890 IFEX>0 THEN 1790
1900 '
1910 IFABS(RT)<>1 THEN 2000
1920 IFRT=-1 THEN PRINT"ATTACKER ELIMINATED";ELSEGOTO 1950
1930 FORHA=1TOHB:GOSUB 25000:NEXT
1940 GOTO 2000
1950 PRINT"DEFENDER ELIMINATED";
1960 GOSUB 24000
2000 IFRT=2 THEN PRINT"DEFENDER RETREATS 2";ELSEGOTO 2100
2005 RD=1
2010 MS$="RT":FL=PC(DR(2),1):FL$=PC$(PC(DR(2),2))
2020 GOSUB 23000
2030 IFA$="E" THEN GOSUB 24000:GOTO 2100
2035 A=VAL(A$):IF(A<1)OR(A>7) THEN 2020
2040 GOSUB 21500:IFAJ<>0 THEN 2020
2045 KP=FL:FL=P:A=1
2050 GOSUB 21500:IFAJ<0 THEN 2070
2055 IFP=KP THEN 2070
2060 IF((S=17)AND(AJ>3)AND(AJ<7))OR((S=1)AND(AJ<4)AND(AJ>0))THEN
FL=KP:GOTO2020
2070 A=A+1:IFA<7 THEN 2050
2075 P=FL:FL=KP:PRINT@FL,"    ";:PRINT@P,FL$;:DR(1)=P:PC(DR(2),1
)=P:GOSUB 21000:BD(Y1,X1)=DR(2):P=FL:GOSUB 21000:BD(Y1,X1)=0
2080 RD=RD+1:IFRD=2 THEN 2010
2100 IFRT=-2 THEN PRINT"ATTACKER RETREATS 2";ELSEGOTO 2500
2110 FORHA=1TOHB
2115 RD=1
2120 MS$="RT":FL=PC(Q(HA,2),1):FL$=PC$(PC(Q(HA,2),2))
2130 GOSUB 23000
2140 IFA$="E" THEN GOSUB 25000:GOTO 2195
2145 A=VAL(A$):IF(A<1)OR(A>7) THEN 2130
2150 GOSUB 21500
2155 IFAJ<>0 THEN 2130
2160 KP=FL:FL=P:A=1
2165 GOSUB 21500:IFAJ<0 THEN 2185
2170 IFP=KP THEN 2185
2175 IF(S=17)AND((AJ=2)OR(AJ=3)OR(AJ=1))THENFL=KP:GOTO2130
2180 IF(S=1)AND((AJ=4)OR(AJ=5)OR(AJ=6))THENFL=KP:GOTO2130
2185 A=A+1:IFA<7THEN2165
2190 P=FL:FL=KP:PRINT@FL,"    ";:PRINT@P,FL$;:Q(HA,1)=P:PC(Q(HA,
2),1)=P:GOSUB 21000:BD(Y1,X1)=Q(HA,2):P=FL:GOSUB 21000:BD(Y1,X1)
=0
2192 RD=RD+1:IFRD=2 THEN 2120
2195 NEXT HA
```

```
2500 FORK=1TO500:NEXTK:PRINT@980,STRING$(42," ");:GOTO 1600
4000 'CHECK FOR DEFENDER SUPPORT
4010 AD=0:FORB=1TOHB:FL=Q(B,1)
4020 FORA=1TO6:GOSUB21500
4040 IF(AJ<=0)OR(AJ=7)OR((S=17)AND(AJ>3))OR((S=1)AND(AJ<4))THEN4
200
4055 IFPC(B1,3)=1THEN4200
4060 F3=0:FORI=STOS+14
4070 F3=0:FORI=STOS+14:F3=F3-(ABS(PC(I,3))=P)
4075 NEXTI
4080 IFF3=0THENAD=AD+1:PC(B1,3)=1:IF(AJ=2)OR(AJ=5)THENAD=AD+1
4200 NEXTA,B:RETURN
20000 DATA1,516
20060 DATA2,576,456,276,156,208,328
20080 DATA3,216,336,396,268,140, 80,260,320
20100 DATA7,200
20110 DATA4,504
20120 DATA5,444,564,744,864,692,812
20140 DATA6,804,624,684,752,700,760,880,940
20150 DATA7,820
20160 DATA-1
20162 DATA-1,-1,-2,-2, 2, 1, 1,1,1,1,1
20163 DATA-1,-1,-1,-2, 0, 0, 0,0,0,2,2
20164 DATA-2,-2,-2,-2,-2, 2, 2, 2,1,1,1
20165 DATA-1,-2,-2,-2,-2,-2,-2, 2,2,2,1
20166 DATA-1,-1,-1,-1,-1,-1, 0, 0,2,1,1
20167 DATA-1,-1,-1,-1,-1,-1,-1, 1,1,1,1
```

```
20180 I=1
20200 READX:IF(X<0) THEN 20262
20220 IF(X<8) THEN Y=X:GOTO 20200
20240 PC(I,1)=X:PC(I,2)=Y
20260 I=I+1:GOTO 20200
20262 FORI=1TO32:P=PC(I,1):GOSUB21000:BD(Y1,X1)=I:NEXTI
20265 FORI=1TO6:FORJ=1TO11:READTB(I,J):NEXT J,I
20280 PC$(2)=" "+CHR$(183)+CHR$(187)+CHR$(132)
20290 PC$(1)=" "+CHR$(157)+CHR$(140)+CHR$(132):
      PC$(4)=CHR$(136)+CHR$(140)+CHR$(174)
20300 PC$(5)=CHR$(136)+CHR$(183)+CHR$(183)
20320 PC$(3)=CHR$(168)+CHR$(173)+CHR$(94):
      PC$(6)=CHR$(93)+CHR$(168)+CHR$(173)
20340 PC$(7)=" "+CHR$(191)+CHR$(191)
20350 A$=CHR$(166):B$=CHR$(153):
     MT$(1)=A$+CHR$(162)+CHR$(145)+B$:
     MT$(2)=A$+A$+B$+B$:
     MT$(3)=A$+CHR$(174)+CHR$(157)+B$
20355 RETURN
20450 IFHX$="Y"THENB1$="     ":B2$=CHR$(153)+CHR$(140)+CHR$(140)+
CHR$(166):R1$=B1$+B2$:R2$=B2$+B1$:R4$="":R3$="":FORI=1TO8:R3$=R3
$+R1$:R4$=R4$+R2$:NEXTI
20500 IFHX$="Y"THENFORI=0TO832STEP128:PRINT@I,R4$;:PRINT@I+64,R3
$;:NEXT:PRINT@896,R4$;
```



```
20520 FORI=1TO32:PRINT@PC(I,1),PC$(PC(I,2));:NEXT
20525 IFMT<1THEN20580ELSEFORK=1TOMT
20530 SD=SD+.528416:R3=15:GOSUB32000:X=RN:R3=14:GOSUB32000:Y=RN
20532 IF(XAND1)=(YAND1)THENX=X+1:IFX>15THENX=X-2
20535 P=64*Y+4*X
20537 FL=P:A=1
20538 GOSUB21500:IFAJ=0THEN20540ELSEA=A+1:IFA>6THEN20530ELSE2053
8
20540 GOSUB21000:R3=3:GOSUB32000:BD(Y1,X1)=-RN:PRINT@P,MT$(-BD(Y
1,X1));
20550 IFY>1 THEN SET(X+2,Y-2):SET(X+5,Y-2)
20560 SET(X+2,Y+2):SET(X+5,Y+2):GOSUB33000
20570 NEXTK
20580 IFRV$="N"THEN20600ELSESD=SE:SR=64::SET(SR,0):SR=SR+1:LN=1
20583 R3=10:GOSUB32000:B1=RN+2:GOSUB32000:B2=RN+2
20585 FORK=0TO14
20586 IFSR>110THENRV=2ELSEIFSR<20THENRV=1ELSER3=2:GOSUB32000:RV=
RN
20590 IF(SRAND1)=1THENGOSUB26000ELSEGOSUB26500
20595 NEXT K
20600 RETURN
21000 Y1=INT(P/64):X1=(P-64*Y1)/4
21010 Y=1+Y1*3:X=X1*8:RETURN
21500 '
21510 ONAGOTO21520,21530,21540,21550,21560,21570,21520
21520 Z=-60:GOTO 21575
21530 Z=68:GOTO 21575
21540 Z=128:GOTO 21575
21550 Z=60:GOTO 21575
21560 Z=-68:GOTO 21575
21570 Z=-128:GOTO 21575
21575 P=FL+Z
21580 Y1=INT(P/64):X1=(P-64*Y1)/4
21590 AJ=0
21600 IF((X1AND1)=(Y1AND1))OR(Y1>14)OR(Y1<0) THEN AJ=-1:RETURN
21610 B1=BD(Y1,X1)
21615 IFB1<0 THENIFI<>S THEN AJ=-1:RETURNELSEAJ=-2:RETURN
21620 IFB1<>0THENAJ=PC(B1,2)
21630 RETURN
22000 GOSUB34000:IFF2=0RETURNELSE:PC(I,3)=P:PC(I,4)=PC(I,4)+1:PC
(I,5)=B1:F2=1:GOSUB 31075:PC(I,6)=RV
22005 PRINT@1000,"ATTACK";:IFRV=1THEN PRINT" ACROSS RIVER";
22007 FORK=1TO1000:NEXT:PRINT@992,STRING$(30," ");
22010 RETURN
23000 'FLICKER FOR INPUT
23010 A$=INKEY$:IFA$<>"" THEN RETURNELSEPRINT@FL,MS$;"  ";:FORJ=
1TO50:NEXT :PRINT@FL,FL$;:GOTO 23010
23999 'DEF. ELIM
24000 FORHA=1TO40:PRINT@DR(1),MT$(RND(3));:NEXT:PRINT@DR(1),"
 ";:PC(DR(2),1)=0:PC(DR(2),3)=0:P=DR(1):GOSUB 21000:BD(Y1,X1)=0:
RETURN
25000 FORHC=1TO40:PRINT@Q(HA,1),MT$(RND(3));:NEXT :PRINT@Q(HA,1)
,"    ";:PC(Q(HA,2),1)=0:PC(Q(HA,2),3)=0:P=Q(HA,1):GOSUB 21000:B
D(Y1,X1)=0
25010 EX=EX-1:AJ=PC(Q(HA,2),2):IF(AJ=2)OR(AJ=5) THEN EX=EX-1
25020 RETURN
26000 IFRV=2THENGOSUB26900:GOTO26100
26010 FORJ=0TO5STEP2:SET(SR+J,LN):NEXT:SR=SR+5:GOSUB26800
26100 LN=LN+3:RETURN
26500 IFRV=1THENGOSUB26800:GOTO26580
26510 FORJ=0TO5STEP2:SET(SR-J,LN):NEXT:SR=SR-5:GOSUB26900
26580 LN=LN+3:RETURN
26800 IF(B1=K)OR(B2=K)THEN26810ELSESET(SR+1,LN+1):SET(SR+2,LN+2)
26810 SR=SR+3:RETURN
26900 IF(B1=K)OR(B2=K) THEN 26910ELSESET(SR-1,LN+1):SET(SR-2,LN+
2)
26910 SR=SR-3:RETURN
30000 GOSUB33000:IFS=17THENPRINT@960,"SOUTHEAST WINS";ELSEPRINT@
960,"NORTHWEST WINS";
30010 PRINT@P,"WIN ";
30020 B$=INKEY$:IFB$=""THEN30020ELSEEND
31074 'RIVER CHK
31075 IFHX$="Y"THENRV=0:RETURNELSEKP=P:P=FL:GOSUB21000:P=KP:RV=0
31080 ON A GOTO 31085,31090,31095,31100,31105,31110,31085
31085 IF(X>120)OR(Y<2)THENRETURNELSEIFPOINT(X+7,Y-2) THEN RV=1
31086 RETURN
31090 IF(X>120)THENRETURNELSEIFPOINT(X+7,Y+2) THEN RV=1
31091 RETURN
31095 IF(X>124)THENRETURNELSEIFPOINT(X+2,Y+3)ORPOINT(X+3,Y+3) TH
EN RV=1
31096 RETURN
31100 IF(X<1)THENRETURNELSEIFPOINT(X-1,Y+1) THEN RV=1
31101 RETURN
31105 IF(X<1)OR(Y<1)THENRETURNELSEIFPOINT(X-1,Y-1) THEN RV=1
31106 RETURN
31110 IF(X>124)OR(Y<3)THENRETURNELSEIFPOINT(X+2,Y-3)ORPOINT(X+3,
Y-3) THEN RV=1
31111 GOTO 31120
31120 RETURN
31999 'RANDOM NO.
32000 R1=SD*997:SD=R1-INT(R1):RN=INT(SD*R3)+1:RETURN
33000 PRINT@960,STRING$(63," ");:RETURN
34000 F2=0:IF(AJ=7)OR(AJ<1)THENRETURN
      ELSEIFNOT(((S=1)AND(AJ>3))OR((S=17)AND(AJ<4)))THEN
      RETURNELSEF2=1:RETURN
35000 LPRINT" ":FORX=15360TO16359STEP64:A$=""
35010 FORY=0TO63:A$=A$+CHR$(PEEK(X+Y))
35020 NEXTY:LPRINTA$:NEXTX:A$="":RETURN
40000 CLS:PRINT@84,"TRS-80 WARGAME  1.1"
      :PRINT@200,"THIS GAME SIMULATES A WAR BETWEEN TWO COUNTR
IES:":PRINT@400,"NORTHWEST  VERSUS  SOUTHWEST"
40002 PRINT@586,PC$(2);:PRINT@615,PC$(5);:PRINT@687,PC$(6);:PRIN
T@712,PC$(3);:PRINT@758,PC$(4);:PRINT@720,PC$(1);:
40010 GOSUB51000
```

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BASICS OF ANIMATION: This program shows you how to animate simple shapes (with sound) using Print & Plot commands and also has a nice Player/Missile graphics game you can play with. **16K (C) £9.95**

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SOUND: Unless you have spent many hours experimenting with the four voice channels of the Atari, you will learn a lot from this one. With many examples of special sound effects. **16K (C) £9.95**

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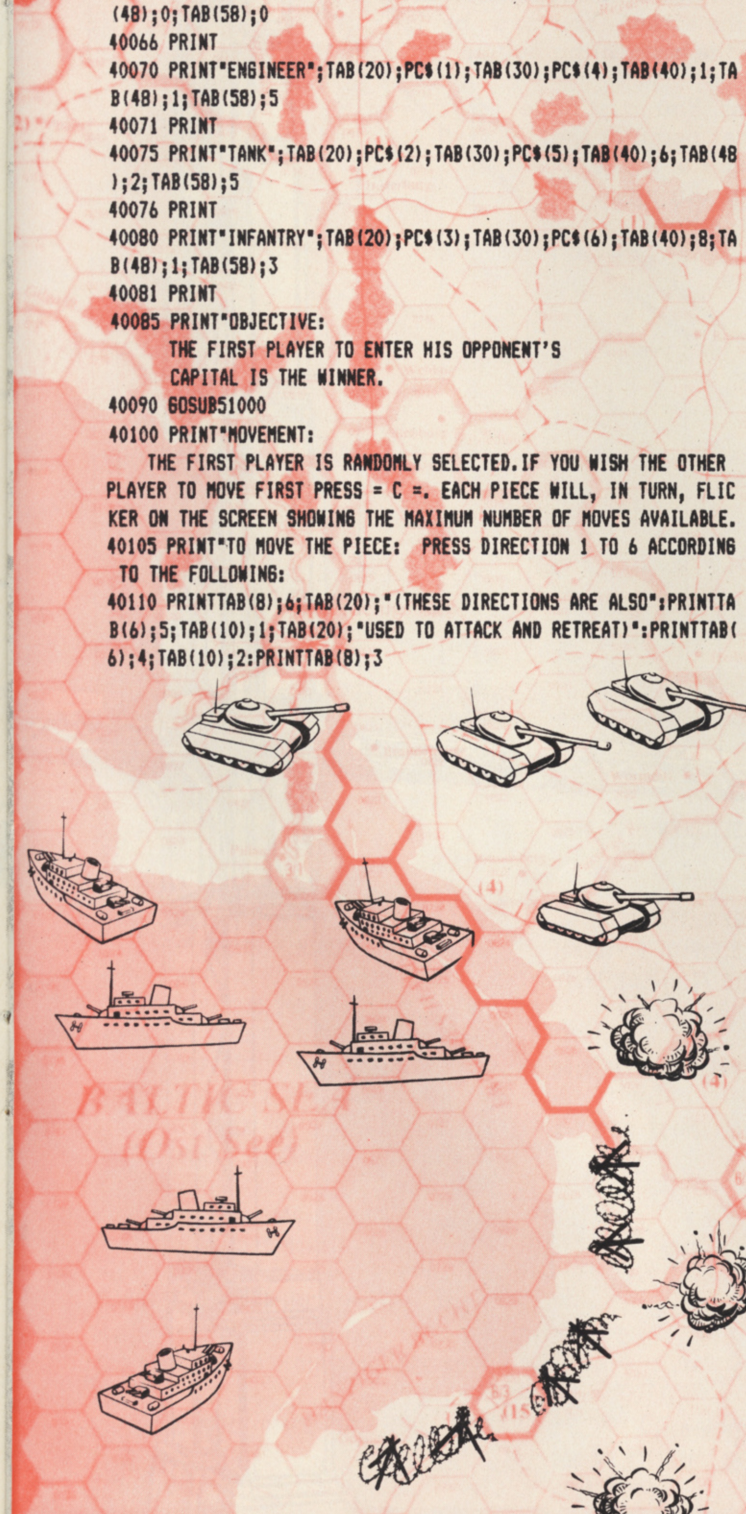
```
40015 PRINT@15,"OPERATING INSTRUCTIONS:"
40020 PRINT
40025 PRINT:PRINT"DO YOU WANT A HEX BOARD?
      IT IS ADVISABLE TO PLAY ON A HEX BOARD UNTIL YOU ARE
      ACCUSTOMED TO THE MOVEMENT OF THE PIECES.
40030 PRINT"HOW MANY MOUNTAINS?
      MOUNTAINS CREATE A MORE INTERESTING GAME. THEY APPEAR AT
      RANDOM ON THE BOARD.
40040 PRINT"DO YOU WANT A RIVER?
      THIS OPTION IS NOT AVAILABLE ON A HEX BOARD.
40045 PRINT"ENTER THE SCENARIO NUMBER
      THIS ENABLES THE SAME SCENARIO TO BE REPLAYED.":GOSUB51000
40056 PRINT"EACH PLAYER HAS 16 PIECES CONSISTING OF:
40060 PRINTTAB(15);"NORTHWEST";TAB(27);"SOUTHWEST";TAB(38);"NUMB
ER";TAB(46);"VALUE";TAB(54);"MOVEMENT"
40061 PRINT
40065 PRINT"CAPITAL";TAB(20);PC$(7);TAB(30);PC$(7);TAB(40);1;TAB
(48);0;TAB(58);0
40066 PRINT
40070 PRINT"ENGINEER";TAB(20);PC$(1);TAB(30);PC$(4);TAB(40);1;TA
B(48);1;TAB(58);5
40071 PRINT
40075 PRINT"TANK";TAB(20);PC$(2);TAB(30);PC$(5);TAB(40);6;TAB(48
);2;TAB(58);5
40076 PRINT
40080 PRINT"INFANTRY";TAB(20);PC$(3);TAB(30);PC$(6);TAB(40);8;TA
B(48);1;TAB(58);3
40081 PRINT
40085 PRINT"OBJECTIVE:
      THE FIRST PLAYER TO ENTER HIS OPPONENT'S
      CAPITAL IS THE WINNER.
40090 GOSUB51000
40100 PRINT"MOVEMENT:
    THE FIRST PLAYER IS RANDOMLY SELECTED.IF YOU WISH THE OTHER
PLAYER TO MOVE FIRST PRESS = C =. EACH PIECE WILL, IN TURN, FLIC
KER ON THE SCREEN SHOWING THE MAXIMUM NUMBER OF MOVES AVAILABLE.
40105 PRINT"TO MOVE THE PIECE:  PRESS DIRECTION 1 TO 6 ACCORDING
 TO THE FOLLOWING:
40110 PRINTTAB(8);6;TAB(20);"(THESE DIRECTIONS ARE ALSO":PRINTTA
B(6);5;TAB(10);1;TAB(20);"USED TO ATTACK AND RETREAT)":PRINTTAB(
6);4;TAB(10);2:PRINTTAB(8);3
```



```
40115 PRINT"IF YOU WISH TO MOVE LESS THAN THE MAXIMUM PRESS = S
=.
YOU MUST STOP IF YOU MOVE NEXT TO AN OPPOSING PIECE (EXCEPT THE
CAPITAL).
 IT TAKES TWO MOVES TO CROSS A RIVER.
40120 GOSUB51000
40125 PRINT:PRINT"NO PIECE MAY ENTER A MOUNTAIN SQUARE.
IF YOU WISH TO MOVE A PIECE IN AN ORDER DIFFERENT FROM THE ORDER
FLICKERED PRESS = H = AND THE TRS-80 WILL REPEAT THIS PIECE WHEN
OTHER MOVEMENT IS COMPLETE.
40130 PRINT"IF YOU DETERMINE THAT MOVEMENT IS COMPLETE AND NO FU
RTHER PIECES NEED BE MOVED PRESS = F =. YOU CAN ALSO PRESS =C=.
 THIS IS FASTER BUT DOES NOT CHECK FOR PIECES STILL ADJACENT FRO
M THE LAST  COMBAT.":GOSUB51000
40135 PRINT"ENGINEER
      THIS PIECE IS ABLE TO CUT A ROAD THROUGH MOUNTAINS.THERE A
RE THREE TYPES OF MOUNTAIN:":PRINT:
40140 FORA=1TO3:PRINTTAB(A*16);A;TAB(A*16+5);MT$(A);:NEXTA:PRINT
:FORY=11TO15STEP4:FORX=44TO108STEP32:SET(X,Y):SET(X+3,Y):NEXTX,Y
:PRINT:PRINT
40145 PRINT"   TO CLEAR THE ROAD MOVE THE ENGINEER IN THAT DIREC
TION. A 3 MOUNTAIN CHANGES TO A 2 MOUNTAIN; A 2 TO A 1 AND A 1 T
O A BLANK SPACE.
40150 PRINT" THE ENGINEER STOPS WHEN CLEARING THE ROAD AND THE R
EMAINDER OF HIS MOVEMENT IS LOST.":PRINT:GOSUB51000
40155 PRINT"RIVER
      IT COSTS TWO MOVES TO CROSS A RIVER UNLESS THERE IS A BRID
GE. ENGINEERS MAY NOT CLEAR A ROAD IF THE RIVER IS IN BETWEEN.
40160 PRINT:PRINT"THE VALUE OF A DEFENDER UNDER ATTACK IS DOUBLE
D IF THE RIVER IS BETWEEN THE DEFENDER AND ATTACKER UNLESS IT IS
 ALSO ATTACKED BY ANOTHER PIECE ON THE SAME SIDE OF THE RIVER.":
GOSUB51000
40165 PRINT"COMBAT:
       WHEN PLAYER MOVES AND PLACES A PIECE NEXT TO AN OPPOSING
 PIECE HE MUST ATTACK. EACH ATTACKING PIECE MUST ATTACK =ONE= DE
FENDER. IF THERE IS AN OPTION, THE PIECE WILL FLICKER WITH =AT=.
"
40167 PRINT"THE PLAYER MUST INDICATE THE DIRECTION OF ATTACK.
 40170 PRINT"     ALL COMBAT TAKES PLACE SIMULTANEOUSLY ON COMPLE
TION OF MOVEMENT"
40175 PRINT"ATTACKER'S FACTORS: INTEGER VALUE OF 150% OF VALUE O
F ATTACKERS.
40180 PRINT"DEFENDER'S FACTORS: VALUE OF DEFENDER PLUS ANY DEFEN
DER

                         ADJACENT TO ATTACKER PROVIDED
                         THAT PIECE IS NOT ALSO UNDER
                         ATTACK.":GOSUB51000
40185 PRINT"COMBAT RESULT:
       ATTACKER'S AND DEFENDER'S ODDS ARE ROUNDED TO SIMPLE ODD
S(E.G. 11 VS 4 BECOMES 2-1). THE FOLLOWING TABLE IS CONSULTED AN
D A RANDOM ROW SELECTED:
40190 PRINT"  1-6 1-5 1-4 1-3 1-2 1-1 2-1 3-1 4-1 5-1 6-1":FORA=
1TO6:FORB=1TO11:PRINTUSING"####";TB(A,B);:NEXTB:PRINT:NEXTA
40192 PRINT:PRINT"-1 A ELIM: -2 A RET: 0 EXCHG: 1 D ELIM: 2 D RE
T":GOSUB51000
40195 PRINT"-1 ATTACKER(S) ELIMINATED.
40200 PRINT" 1 DEFENDER ELIMINATED.
40205 PRINT" 0 EXCHANGE   ATTACKER MUST ELIMINATE UP TO VALUE OF
 DEFENDER.IF THERE IS AN OPTION THE ATTACKERS FLICKER WITH =EL=.
PRESS =E= TO ELIMINATE. PRESS =N= IF YOU DO NOT WISH TO ELIMINAT
E.FLICKERING CONTINUES UNTIL SUFFICIENT ELIMINATED.
40210 PRINT"-2 ATTACKER RETREATS 2 HEX:":PRINT" 2 DEFENDER RETRE
ATS 2 HEX:
40415 PRINT"THE PIECE FLICKERS WITH=RT=.IT MUST RETREAT AND NOT
PASS THROUGH ANY HEX ADJACENT TO AN OPPONENT OR MOVE OFF BOARD.I
F IT CANNOT, PRESS =E= TO ELIMINATE.
51000 PRINT@960,"PRESS =ENTER= TO CONTINUE ( =P= TO PRINT )";
51050 B$=INKEY$:IFB$=""THEN51050
51060 IFB$="P"GOSUB35000
51080 CLS:RETURN
```

ENGINEER

Have you ever had the urge to build a bridge but just couldn't find the time or place to construct one? If so, then this simulation is for you.

The object of this game is to successfully build a bridge from the ground up. You have been hired by the San Francisco Public Works Commission to rebuild the famous Golden Gate which was recently destroyed by a powerful invasion from space. You must connect the two blocks at the top of the screen. You do so by placing beams from the bottom until you can support the connecting beams across the top.

There are only a few rules, as you are your own boss. You must have the right end of the beams supported by either another beam or the rocky cliffs on the side. The only other item to be aware of is the ever-present inspector, who will walk up and down during construction. All he asks of you is that you lay beams below his feet only — so you can't drop one on his head.

The game itself is simple to play and win, so the challenge is in completing the entire work in as few days as possible. To play, all you need is an 8K Atari with one joystick, which goes into the leftmost slot.

VARIABLES
DA — days of construction so far.
X, Y — location of inspector.
M, N — location of pointer on screen.

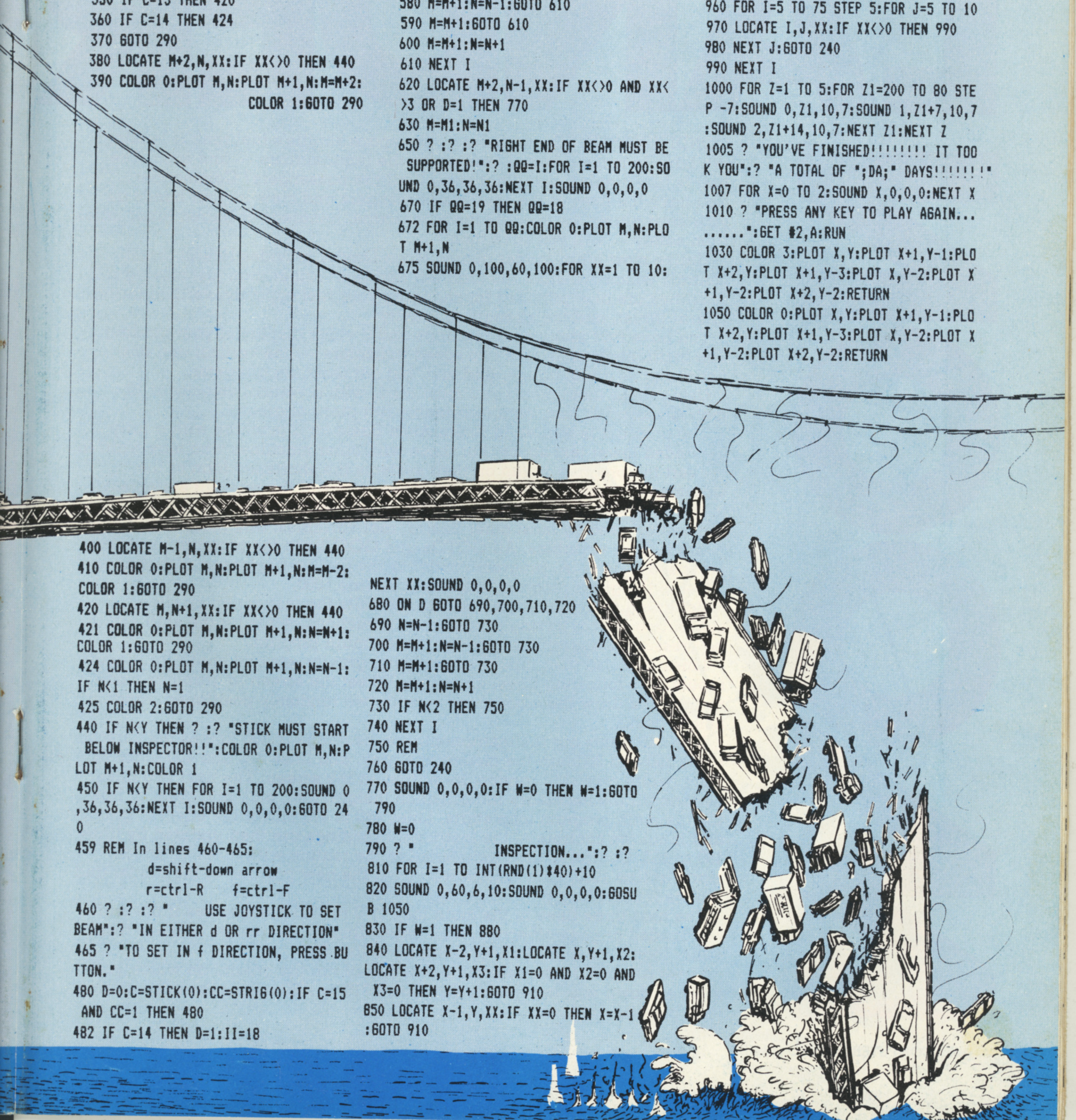
```
10 GRAPHICS 0:POSITION 13,0:? "BRIDGE
BUILDER":POSITION 19,1:? "BY":POSITION
 14,2:? "JAMES HAGANI"
15 POKE 752,1:OPEN #2,4,0,"K:"
20 ? :? :? " YOU ARE NOW AN OFFICIAL E
NGINEER!!!":? "YOUR MISSION IS TO BUIL
D A BRIDGE"
25 ? "CONNECTING THE TWO BLOCKS AT THE
 TOP":? "OF OF THE SCREEN. YOU DO SO B
Y PLACING";
30 ? "BEAMS BELOW THE INSPECTOR'S FEET
.":? "SIMPLY MOVE THE POINTER TO THE P
LACE"
35 ? "WHERE YOU WISH TO PLACE THE BEAM
, THEN";:? "ENTER THE DIRECTION YOU WI
SH TO SET"
40 ? "THE BEAM. TRY TO CONSTRUCT THE B
RIDGE":? "IN AS FEW DAYS AS POSSIBLE."
:? :? "      HIT ANY KEY TO BEGIN..."
50 GET #2,A
150 GRAPHICS 5:SETCOLOR 2.0.0:POKE 752
,1:SETCOLOR 1,11,10:SETCOLOR 0,15,0:SE
TCOLOR 4,8,4
155 COLOR 1
160 FOR X=0 TO 79:PLOT X,39:NEXT X
165 PLOT 0,8:DRAWTO 5,8:PLOT 0,9:DRAWT
O 5,9:PLOT 79,8:DRAWTO 74,8:PLOT 79,9:
DRAWTO 74,9
170 Y=10:D=71:X=4
190 PLOT 0,Y:DRAWTO X+3,Y:PLOT 79,Y:DR
AWTO X+D-3,Y
200 Y=Y+1:IF INT(RND(1)*10)>3 THEN X=X
+1:D=D-2
210 IF Y=39 THEN 220
215 GOTO 190
220 X=29+INT(RND(1)*17):Y=38
230 GOSUB 1030
240 M=INT(RND(1)*31)+25:N=0
260 LOCATE M,N+1,XX
262 IF XX<>0 THEN 280
270 N=N+1:GOTO 260
280 N=N-10:IF N<0 THEN N=0
285 ? :? :? :? :? "USE JOYSTICK TO MOV
E BEAM POINTER...":? "_      DAY # ";DA
```

RUNS ON AN ATARI IN 8K

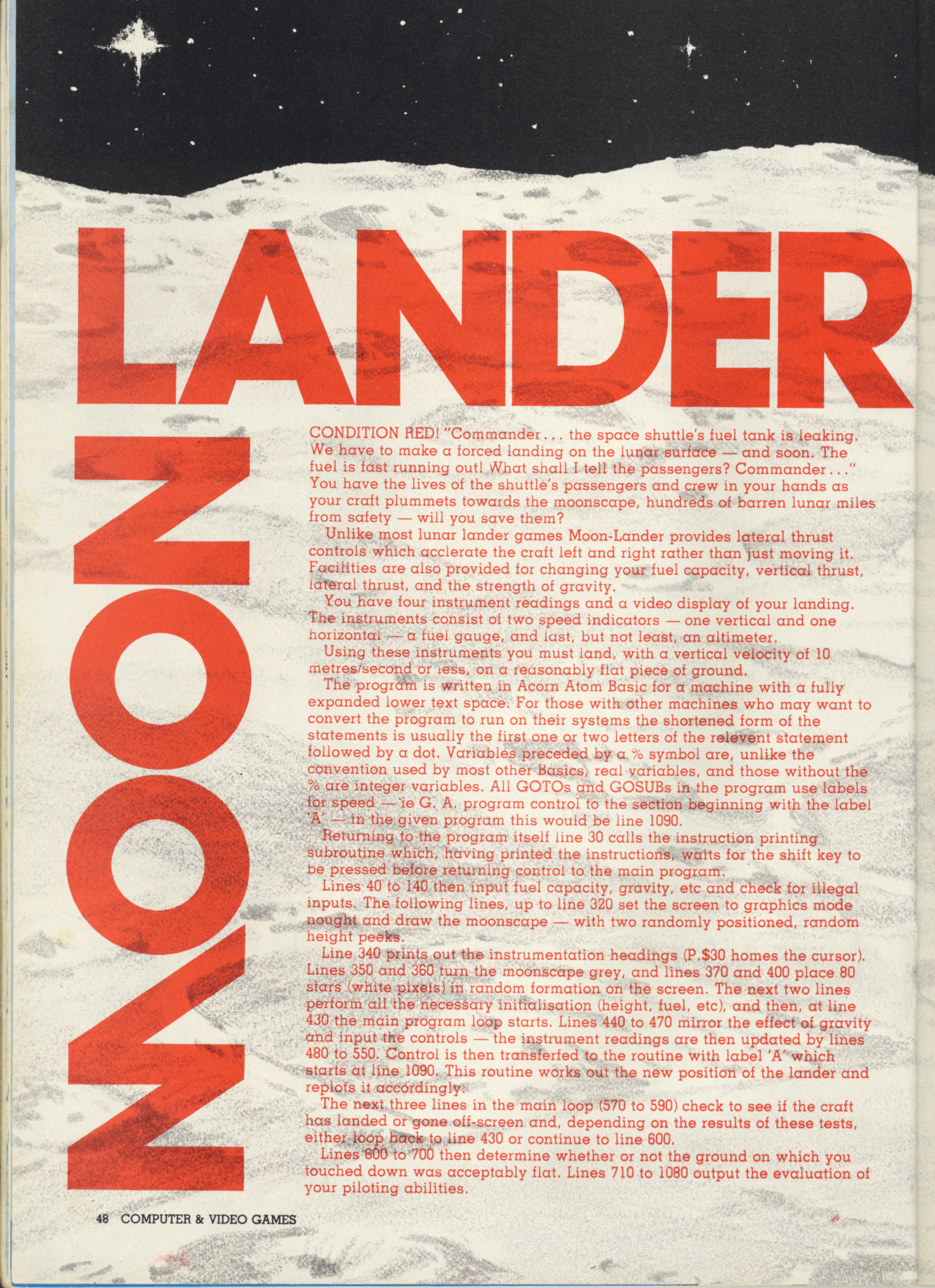
WITH A JOYSTICK

BY DAVID BOHLKE

```
+1;" OF CONSTRUCTION.":?
290 COLOR 2:PLOT M,N:PLOT M+1,N
320 FOR XX=1 TO 20:NEXT XX:C=STICK(0):
IF C=15 THEN 320
330 IF C=7 THEN 380
340 IF C=11 THEN 400
350 IF C=13 THEN 420
360 IF C=14 THEN 424
370 GOTO 290
380 LOCATE M+2,N,XX:IF XX<>0 THEN 440
390 COLOR 0:PLOT M,N:PLOT M+1,N:M=M+2:
                          COLOR 1:GOTO 290
```



```
400 LOCATE M-1,N,XX:IF XX<>0 THEN 440
410 COLOR 0:PLOT M,N:PLOT M+1,N:M=M-2:
COLOR 1:GOTO 290
420 LOCATE M,N+1,XX:IF XX<>0 THEN 440
421 COLOR 0:PLOT M,N:PLOT M+1,N:N=N+1:
COLOR 1:GOTO 290
424 COLOR 0:PLOT M,N:PLOT M+1,N:N=N-1:
IF N<1 THEN N=1
425 COLOR 2:GOTO 290
440 IF N<Y THEN ? :? "STICK MUST START
 BELOW INSPECTOR!!":COLOR 0:PLOT M,N:P
LOT M+1,N:COLOR 1
450 IF N<Y THEN FOR I=1 TO 200:SOUND 0
,36,36,36:NEXT I:SOUND 0,0,0,0:GOTO 24
0
459 REM In lines 460-465:
          d=shift-down arrow
          r=ctrl-R    f=ctrl-F
460 ? :? :? "      USE JOYSTICK TO SET
BEAM":? "IN EITHER d OR rr DIRECTION"
465 ? "TO SET IN f DIRECTION, PRESS BU
TTON."
480 D=0:C=STICK(0):CC=STRIG(0):IF C=15
 AND CC=1 THEN 480
482 IF C=14 THEN D=1:II=18
483 IF CC=0 THEN D=2:II=18
484 IF C=7 THEN D=3:II=18
485 IF D<1 OR D>3 THEN 480
510 DA=DA+1:M1=M:N1=N
520 FOR I=1 TO 18
525 SOUND 0,100,60,100:FOR XX=1 TO 10:
NEXT XX:SOUND 0,0,0,0
530 IF M>76 OR N<4 OR M<2 THEN 620
540 COLOR 2:PLOT M,N:PLOT M+1,N
550 LOCATE M+2,N,XX:IF XX<>0 AND XX<>3
 THEN 770
560 ON D GOTO 570,580,590,600
570 I=I+INT(RND(1)*2):N=N-1:I1=I1+1:GO
TO 610
580 M=M+1:N=N-1:GOTO 610
590 M=M+1:GOTO 610
600 M=M+1:N=N+1
610 NEXT I
620 LOCATE M+2,N-1,XX:IF XX<>0 AND XX<
>3 OR D=1 THEN 770
630 M=M1:N=N1
650 ? :? :? "RIGHT END OF BEAM MUST BE
 SUPPORTED!":? :QQ=I:FOR I=1 TO 200:SO
UND 0,36,36,36:NEXT I:SOUND 0,0,0,0
670 IF QQ=19 THEN QQ=18
672 FOR I=1 TO QQ:COLOR 0:PLOT M,N:PLO
T M+1,N
675 SOUND 0,100,60,100:FOR XX=1 TO 10:
NEXT XX:SOUND 0,0,0,0
680 ON D GOTO 690,700,710,720
690 N=N-1:GOTO 730
700 M=M+1:N=N-1:GOTO 730
710 M=M+1:GOTO 730
720 M=M+1:N=N+1
730 IF N<2 THEN 750
740 NEXT I
750 REM
760 GOTO 240
770 SOUND 0,0,0,0:IF W=0 THEN W=1:GOTO
 790
780 W=0
790 ? "          INSPECTION...":? :?
810 FOR I=1 TO INT(RND(1)*40)+10
820 SOUND 0,60,6,10:SOUND 0,0,0,0:GOSU
B 1050
830 IF W=1 THEN 880
840 LOCATE X-2,Y+1,X1:LOCATE X,Y+1,X2:
LOCATE X+2,Y+1,X3:IF X1=0 AND X2=0 AND
 X3=0 THEN Y=Y+1:GOTO 910
850 LOCATE X-1,Y,XX:IF XX=0 THEN X=X-1
:GOTO 910
860 LOCATE X,Y-1,XX:IF XX=0 THEN Y=Y-1
:GOTO 910
870 GOTO 910
880 LOCATE X+1,Y+1,XX:LOCATE X+3,Y+1,X
1:LOCATE X,Y+1,X2:IF X2=0 AND XX=0 AND
 X1=0 THEN Y=Y+1:GOTO 910
890 LOCATE X+3,Y,XX:IF XX=0 THEN X=X+1
:GOTO 910
900 LOCATE X,Y-1,XX:IF XX=0 THEN Y=Y-1
:GOTO 910
910 GOSUB 1030:IF Y<6 OR X<5 OR X>69 T
HEN 930
920 NEXT I
930 REM
960 FOR I=5 TO 75 STEP 5:FOR J=5 TO 10
970 LOCATE I,J,XX:IF XX<>0 THEN 990
980 NEXT J:GOTO 240
990 NEXT I
1000 FOR Z=1 TO 5:FOR Z1=200 TO 80 STE
P -7:SOUND 0,Z1,10,7:SOUND 1,Z1+7,10,7
:SOUND 2,Z1+14,10,7:NEXT Z1:NEXT Z
1005 ? "YOU'VE FINISHED!!!!!!!! IT TOO
K YOU":? "A TOTAL OF ";DA;" DAYS!!!!!!!"
1007 FOR X=0 TO 2:SOUND X,0,0,0:NEXT X
1010 ? "PRESS ANY KEY TO PLAY AGAIN...
......":GET #2,A:RUN
1030 COLOR 3:PLOT X,Y:PLOT X+1,Y-1:PLO
T X+2,Y:PLOT X+1,Y-3:PLOT X,Y-2:PLOT X
+1,Y-2:PLOT X+2,Y-2:RETURN
1050 COLOR 0:PLOT X,Y:PLOT X+1,Y-1:PLO
T X+2,Y:PLOT X+1,Y-3:PLOT X,Y-2:PLOT X
+1,Y-2:PLOT X+2,Y-2:RETURN
```



MOON LANDER

CONDITION RED! "Commander . . . the space shuttle's fuel tank is leaking. We have to make a forced landing on the lunar surface — and soon. The fuel is fast running out! What shall I tell the passengers? Commander . . ." You have the lives of the shuttle's passengers and crew in your hands as your craft plummets towards the moonscape, hundreds of barren lunar miles from safety — will you save them?

Unlike most lunar lander games Moon-Lander provides lateral thrust controls which acclerate the craft left and right rather than just moving it. Facilities are also provided for changing your fuel capacity, vertical thrust, lateral thrust, and the strength of gravity.

You have four instrument readings and a video display of your landing. The instruments consist of two speed indicators — one vertical and one horizontal — a fuel gauge, and last, but not least, an altimeter.

Using these instruments you must land, with a vertical velocity of 10 metres/second or less, on a reasonably flat piece of ground.

The program is written in Acorn Atom Basic for a machine with a fully expanded lower text space. For those with other machines who may want to convert the program to run on their systems the shortened form of the statements is usually the first one or two letters of the relevent statement followed by a dot. Variables preceded by a % symbol are, unlike the convention used by most other Basics, real variables, and those without the % are integer variables. All GOTOs and GOSUBs in the program use labels for speed — ie G. A. program control to the section beginning with the label 'A' — in the given program this would be line 1090.

Returning to the program itself line 30 calls the instruction printing subroutine which, having printed the instructions, waits for the shift key to be pressed before returning control to the main program.

Lines 40 to 140 then input fuel capacity, gravity, etc and check for illegal inputs. The following lines, up to line 320 set the screen to graphics mode nought and draw the moonscape — with two randomly positioned, random height peeks.

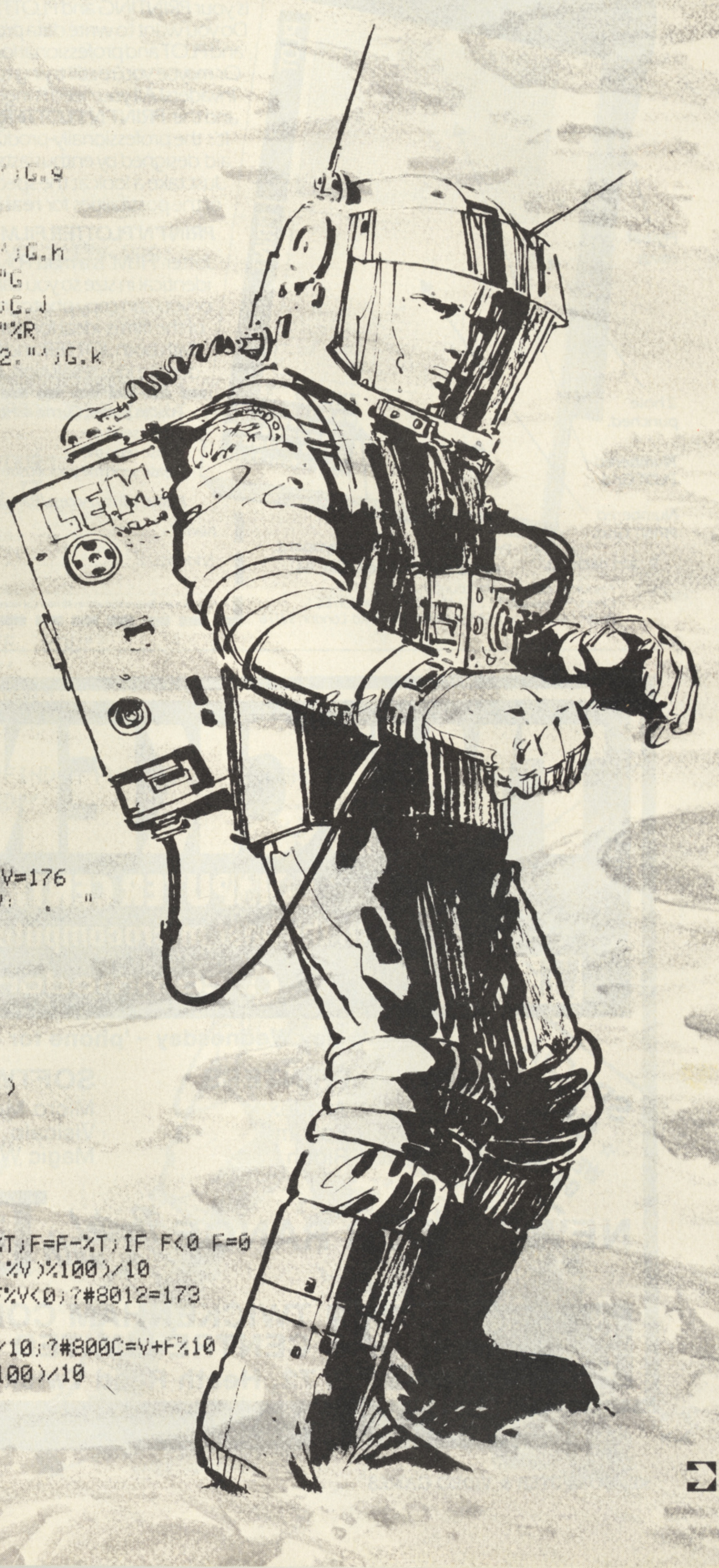
Line 340 prints out the instrumentation headings (P.$30 homes the cursor). Lines 350 and 360 turn the moonscape grey, and lines 370 and 400 place 80 stars (white pixels) in random formation on the screen. The next two lines perform all the necessary initialisation (height, fuel, etc), and then, at line 430 the main program loop starts. Lines 440 to 470 mirror the effect of gravity and input the controls — the instrument readings are then updated by lines 480 to 550. Control is then transferfed to the routine with label 'A' which starts at line 1090. This routine works out the new position of the lander and replots it accordingly.

The next three lines in the main loop (570 to 590) check to see if the craft has landed or gone off-screen and, depending on the results of these tests, either loop back to line 430 or continue to line 600.

Lines 600 to 700 then determine whether or not the ground on which you touched down was acceptably flat. Lines 710 to 1080 output the evaluation of your piloting abilities.

BY S. DRAPER

RUNS ON AN ACORN ATOM IN 12K



```
10DIMHH63,NN8
20Q=#9000;L=#9090
30GOS.i
40gP.$12$10$10
50FIN."GRAVITY (1 TO 10)"%G
60IF%G<0OR%G>10P."BETWEEN 0 & 10."';G.g
70hP.$10;FIN."THRUST (0-20)"%T
80D=#7F7F7F7F;H=32
90IF%T<0OR%T>20P."BETWEEN 0 & 20."';G.h
100jP.$10;IN."FUEL CAPACITY (1-999)"G
110IFG<1ORG>999P."BETWEEN 1 & 999"';G.j
120kP.$10;FIN."LATERAL THRUST (0-2)"%R
130IF %R<0OR %R>2;P."BETWEEN 0 AND 2."';G.k
140yGOS.w
150CLEAR0
160X=0;Y=5;F=G;HH0=5;R=A.R.%54
170MOVE0,0;DRAW0,5
180lP=A.R.%54
190IF(P<R+9A.P>R)OR(R<P+9A.R>P);G.l
200T=P;IF R.%3>0G.n
210oT=A.R.%54
220IF(T<R+9A.T>R)OR(R<T+9A.R>T);G.o
230nDO X=X+1
240IF X>R A.X<R+9G.p
250Y=Y+R.%3
260IF A.(X-P)<5OR A.(X-T)<5;G.q
270IF Y>15  Y=14
280pMOVEX,0
290DRAWX,Y
300IFY<0Y=0
310HH(X)=Y+5
320U.X=63
330B=#40404040;T=#40404040;Y=#8000;V=176
340P.$30"ALT:    ,F:    ,V.V:      ,H.V:  .  "
350F.I=#8000TO#8200
360?I=?I|128;N.
370F.I=1TO80
380X=#8000+A.R.%512
390IF?X=192OR?X<128;?X=65
400N.
410%Z=44;%V=0;%H=0;%S=FLT(A.R.%56+1)
420M=1
430DO
440r%V=%V+%G
450IF?#B001<128;%H=%H-%R
460IF(?#B002)&64<>64;%H=%H+%R
470IF(?#B001)&64<>64AND F>0;%V=%V-%T;F=F-%T;IF F<0 F=0
480?#8013=V+A.%V/100;?#8014= V+A.((%V)%100)/10
490?#8015=V+A.(%V)%10;?#8012=171;IF%V<0;?#8012=173
500?#801C=V+A.((%H)%10)
510?#800A=V+F/100;?#800B=V+(F%100)/10;?#800C=V+F%10
520?#8004=V+%Z/100;?#8005=V+((%Z)%100)/10
530?#8006=V+(%Z)%10
540X=%H;?#801E=V+A.%((%H-X)*10)
```

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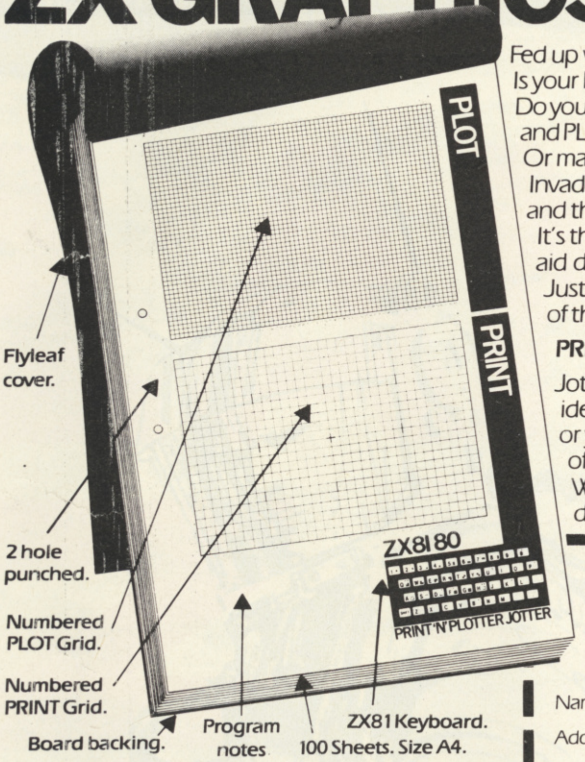
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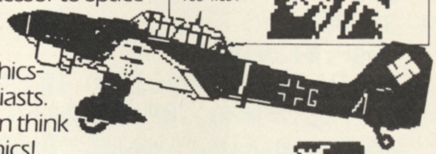

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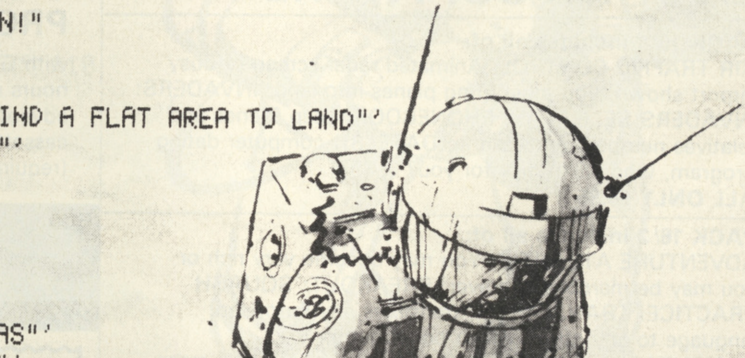
```
 550?#801B=171;FIF%H<0;?#801B=173
 560G.a
 570cIF%Z<0;%S=10;G.m
 580IF%S>56OR%S<1G.r
 590mU.%Z<HH(%S+1)+2OR%Z<HH(%S+3)+2OR%Z<HH(%S+6)+2
 600B=0
 610F.I=%S-(%S)%2 TO %S-(%S)%2+6
 620NN(I+1-%S)=0
 630IF HH(I)>B B=HH(I)
 640N.
 650F.I=%S-(%S)%2 TO %S-(%S)%2+6
 660IFHH(I)<B-7NN1=1;NN2=1;NN3=1;G.s
 670NN(B-HH(I))=1
 680sN.;C=0
 690F.I=0TO7;IFNN(I)=1C=C+1
 700N.
 710P.$12$10$10"    YOUR TOUCH DOWN VELOCITY WAS"
 720@=0
 730P.%V" METRES PER SECOND WHICH "
 740@=4
 750IF%V<6P."WAS   LOVELY"';G.d
 760IF%V<11P."WAS   A BIT ROUGH ON YOUR PASSENGERS."';G.e
 770IF%V<15P."      MODERN LANDING CRAFT JUST CAN'T TAKE."';G.f
 780P."IS   SOMEWHAT HIGH."'
 790P."I DON'T KNOW WHAT YOU THINK YOUR"
 800P."DOING, BUT YOU WON'T BE DOING IT"
 810P."ANY MORE - YOUR SHIP HAS JUST"'
 820P."BEEN SPREAD LIBERALLY OVER 50"'
 830P."SQUARE KILOMETERS OF MOON-"
 840P.'"SURFACE."'
 850IFC<3G.t
 860IFC>2P."    AND TO TOP IT ALL OFF, YOU"'
 870P."DIDN'T EVEN MANAGE TO FIND A"'
 880P."FLAT PIECE OF GROUND TO LAND ON!"
 890G.t
 900dIFC<3G.t
 910P."    HOWEVER, YOU DIDN'T"';P."FIND A FLAT AREA TO LAND"'
 920P."ON AND YOUR SHIP WAS DESTROYED"'
 930P."ANYWAY."';G.t
 940eIFC<3G.t
 950P."HOWEVER, IN VIEW OF THE FACT"'
 960P."THAT YOU CAME DOWN ON ROUGH"'
 970P."GROUND I SHOULDN'T THINK THEY"
 980P.'"FELT MUCH SINCE YOUR LANDER WAS"'
 990P."SPLATTERED OVER A FAIRLY LARGE"'
1000P."AREA."';G.t
1010fIFC<3G.t
1020P.'"    IN RETROSPECT YOUR TOUCH"'
1030P."DOWN VELOCITY WAS LARGELY "'
1040P."IRRELEVENT SINCE YOU SUCCEEDED"'
1050P."IN FINDING A MINATURE MOUNTAIN"'
1060P."RANGE TO LAND ON AND YOUR SHIP"'
1070P."WAS DESTROYED ON IMPACT."'
1080G.t
1090aIFM=1G.b
1100IFP<Y+H;G.b
1110!P=R;P!H=B
```



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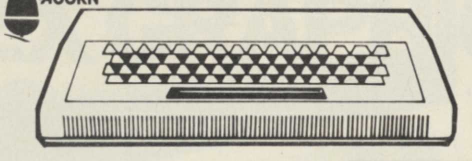

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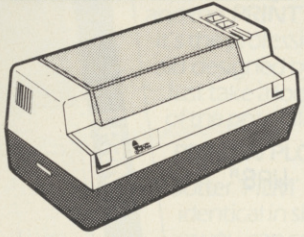

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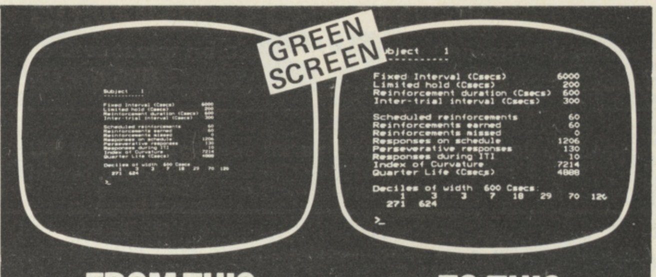

```
ubject    1
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Fixed Interval (Csecs)               6000
Limited hold (Csecs)                  200
Reinforcement duration (Csecs)        600
Inter-trial interval (Csecs)          300

Scheduled reinforcements               60
Reinforcements earned                  60
Reinforcements missed                   0
Responses on schedule                1206
Perseverative responses               130
Responses during ITI                   10
Index of Curvature                   7214
Quarter Life (Csecs)                 4808

Deciles of width  600 Csecs:
     1     3     3     7    18    29    70   126
   271   624

>_
```

FROM THIS ——— TO THIS AT THE FLICK OF A SWITCH

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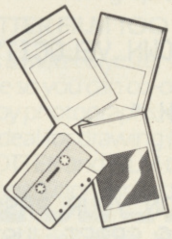

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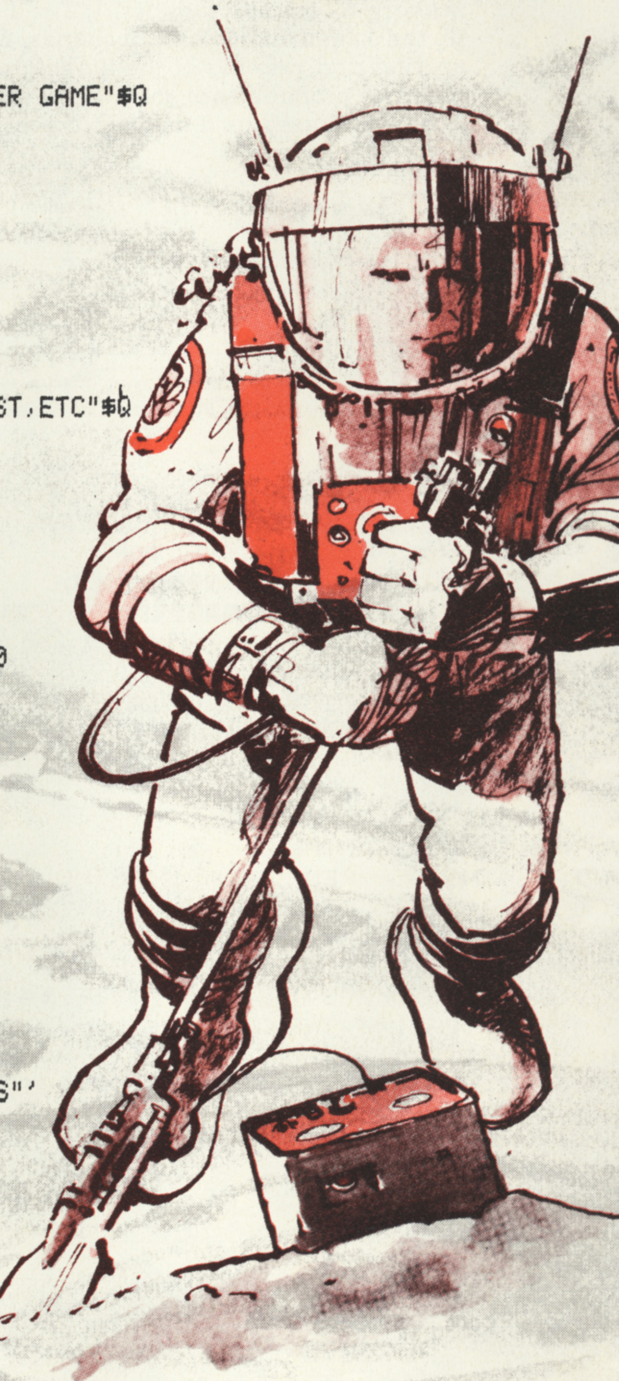
```
1120b%Z=%Z-%V/10;%S=%S+%H;IF%S>56;G.c
1130IF%S<1G.c
1140P=Y+%S/2-H*(%Z/3)+512
1150IFP<Y+H;G.c
1160M=0;R=!P;B=P!H
1170G.(1180+30*((%Z)%3))
1180!P=#40424140¦R;P!H=#4C7C7C4C¦B
1190!P=!P&O;P!H=P!H&O
1200G.c
1210!P=#404B4740¦R;P!H=#70707070¦B
1220!P=!P&O;P!H=P!H&O
1230G.c
1240!P=#436F5F43¦R;P!H=B
1250!P=!P&O;P!H=P!H&O
1260G.c
1280tGOS.w
1290xP.$12$10$10;IN."WOULD YOU LIKE ANOTHER GAME"$Q
1300$L=$Q;Q?1=13
1310IF$Q="Y"G.u
1320IF$Q="N" G.v
1330P.$L" NOT VALID, PLEASE REDO."
1340F.I=1TO80;WAIT;N.
1350G.x
1360vP.$10"AW SHUCKS....BYE"
1370F.I=1TO15;WAIT;WAIT;P."E";N.
1380P.';E.
1390uP.$10;IN."WITH PRESENT GRAVITY, THRUST,ETC"$Q
1400$L=$Q;?(Q+1)=13
1410IF$Q="Y"G.y
1420IF$Q="N"G.9
1430P.$L" NOT VALID, PLEASE REDO."';G.u
1440qIFR.%4>2G.p
1450Y=Y+A.R.%4
1460G.p
1470iP.$12$10$10"     MOON - LANDER"'$10
1480P."   THIS IS A MOON-LANDING"'
1490P."SIMULATION IN WHICH YOU PILOT"'
1500P."THE LANDING CRAFT."'
1510P."   IN ORDER TO SURVIVE THE "'
1520P."LANDING YOU MUST LAND ON FLAT"'
1530P."GROUND WITH A VERTICAL VELOCITY"'
1540P."(V.V.) OF LESS THAN 11 METRES"'
1550P."PER SECOND. TO DO THIS YOU HAVE"'
1560P."THE FOLLOWING CONTROLS:"'
1570P."   'SHIFT'-ACCELERATE LEFT."'
1580P."   'REPT' -ACCELERATE RIGHT."'
1590P."   'CTRL' -ACCELERATE UPWARDS."'
1600GOS.w
1610P.$12$10"   ON THE DISPLAY AS WELL AS"'
1620P."THE VIDEO OF YOUR LANDING ARE"'
1630P."YOUR INSTRUMENT READINGS -"'
1640P."VERTICAL VELOCITY-V.V. (-VE UP),"
1650P."HORIZONTAL VELOCITY-H.V."'
1660P."(+VE RIGHT), ALTITUDE-ALT, AND"'
1670P."FUEL-F."'
1680P."   ALL PARAMETERS ARE VARIABLE"'
1690P."BY THE USER BUT NOTE - HIGHER"'
1700P."THRUSTS MEAN MORE FUEL IS USED."'
1710GOS.w;R.
1720wP.$10"PRESS 'SHIFT' TO CONTINUE."
1730zIF?#B001>127G.z
1740R.
```



SUB ATT

Deep beneath the waves lurks a horribly beweaponed submarine waiting for its prey — a convoy of cargo ships protected by launches, fast patrol boats and aircraft carriers.

The aim is score the highest number of points in one minute. You have an unlimited supply of missiles which are fired by pressing 0. If 0 is pressed again before the first missile has reached its target it will self-destruct and a second will fire from the sub.

Bonus points are awarded for accuracy. The closer to the centre of the ship your missile lands the more points you score. I and P are used to move the sub left and right.

The highest score for this program so far is 1100. Can you beat it?

Notes on the program: S$=submarine; T${cargo ship, E=2; C$=carrier, E-I; LA$=launch, E=3; SP$=speedboat, E=4.

B: random number −I or I, which decides which direction T$ AND C$ move. C: height of the missile. It is used to stop the missile going over the scenery. D: random number, 1, 2 or 3, which decides the height of the ships up the screen and volume of sounds. E: changes for each ship and is used for scoring and printing of the sinking ships. G: random number 1–10, which provides probability of ship appearing. I: gives the horizontal position of the missiles. J: used as a delay to create radar sound.

```
5 POKE36879,61
7 GOTO2000:REM INTRODUCTION
10 PRINT"▣";
11 DEFFNR(X)=INT(X*RND(2))+1:REM RANDOM NO.
12 NO=36877:V=36878:SO=36876:REM WHITE NOISE,VOL. & SOUND
15 REM** BACKGROUND **
20 PRINT"▦___\◤ ▀▀/__________▒__________█ ▄▦▨   █___________";
30 PRINT"█  ▨ █    ___▨  ‾  ‾‾‾‾▀▄____▨ █▄___";
35 PRINT"▦‾‾▨  _   __▄▀▀▌▄__ _▦‾‾▨▄█    ▀";
45 PRINT"█   ___▄__     ◢◤ ‾‾▀▙"
50 REM SUB & SHIPS
110 S$="▓█  ▨ █ ▨████▌ ▨‾    ‾‾█ ":T=8:CO=30720
120 T$="▨  ▄█ | ▨┬┬ ▨████████▨ ▀▨C62█◤ "
130 SP$="█ ┬ ▨▨▀▨█████▨  ▨6 ▨◤"
140 C$=" ▄▄▨▨ ▨▄____ ▨████████▌ ▄▀▨    █◤ "
150 LA$=" ▨┬ ▨◤▌ ▨▨▀ ▨██████▀▨      ▀█ "
155 IFK=1THEN2065
157 REM SAND ON BOTTOM
160 PRINT"▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨          ";S$:PRINT"▦▨‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾";
170 POKE8185,227:POKE38905,7
180 POKE198,0:REM CLEAR KEYBOARD BUFFER
190 TI$="000000"
270 GOTO700
280 IFTI$>"000100"THEN292
285 IFC>0THEN650:REM  MOVE MISSILE
290 GOTO1000:REM MOVE SHIPS
292 POKENO,0
295 PRINT"▨▨▨YOUR SCORE IS";SC:FORT=1TO5000:NEXT:CLR:GOTO10
300 POKESO,0:POKE38417,1:GETA$:IFA$="O"THEN600:REM TEST FOR FIRING
305 IFPEEK(203)=64THEN280
310 IFPEEK(203)=12THENT=T-1:GOTO500
320 IFPEEK(203)=13THENT=T+1:GOTO500
340 GOTO280
400 REM MOVE SUB
500 IFT<0THENT=T+1:GOTO280
510 IFT>14THENT=T-1:GOTO280
520 PRINT"▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨"TAB(T)S$:GOTO280
590 REM START MISSILE
600 IFPEEK(M)=93THENPOKEM,32
610 POKESO,250:M=8100+T:POKEM,93:POKEM+CO,1:C=1:I=T+1:GOTO1000
640 REM MOVE MISSILE
650 POKESO,0:POKEM,32:M=M-22:C=C+1
660 IFC>15THENC=0:GOTO1000
675 IFPEEK(M)=32THENPOKEM+CO,1:POKEM,93:GOTO1000
680 GOSUB910:GOSUB1500:C=0:SC=SC+(20*E)
700 D=FNR(3):G=FNR(10):REM D=VOL. & HGT.
```

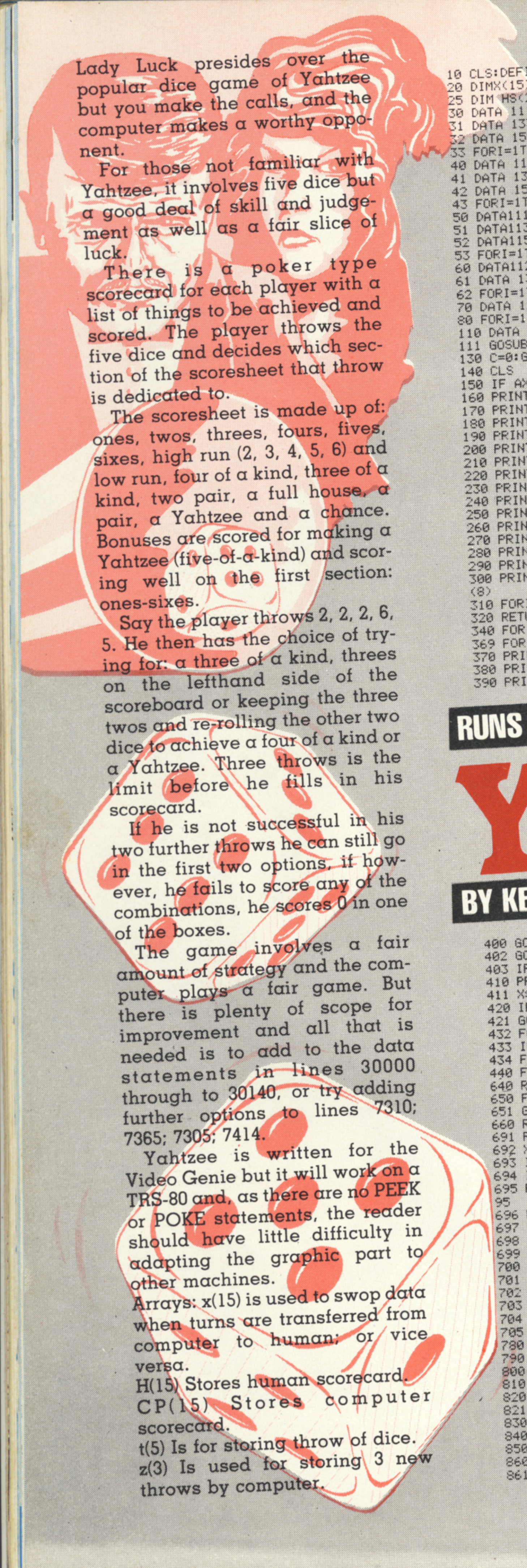
```
710 B=INT(2*RND(1))*2-1:REM DIRECTION OF     SHIPS
715 GOSUB900:POKEV,D
720 ONGGOTO750,780,780,780,800,800,800,800,830,830
750 PRINTSP$:T(4)=0:E=4:POKENO,152:GOTO1000
780 POKENO,210:E=2
785 IFB=1THENT(2)=0:PRINTT$:GOTO1000
790 T(2)=14:PRINTTAB(14)T$:GOTO1000
800 E=1:POKENO,230
810 IFB=1THENT(1)=0:PRINTC$:GOTO1000
820 T(1)=14:PRINTTAB(14)C$:GOTO1000
830 POKENO,148:PRINTTAB(14)LA$:T(3)=14:E=3:GOTO1000
900 PRINT"▒▒▒▒":FORX=1TOD:PRINT:NEXT:RETURN:REM SETS THE HEIGHT
910 GOSUB900:PRINTTAB(I)"▚▟▞▄▒█▌ ▒█▛▄ ▚":POKEV,15:REM EXPLOSION
920 FORX=255TO128STEP-1:POKENO,X:NEXT:POKENO,250
921 GOTO1510
922 REM SINKING
923 FORX=15TO0STEP-.04:POKEV,X:NEXT
925 POKEV,2:POKE198,0
930 POKENO,0:GOSUB900:RETURN
990 REM MOVE SHIPS
1000 POKE38417,0
1002 J=J+1:IFJ=10THENJ=0:POKE36876,230:REM  RADAR SOUNDS
1003 GOSUB900
1005 ONEGOTO1090,1050,1110,1010
1010 T(4)=T(4)+1
1015 IFT(4)>16THENGOSUB1500:GOTO700
1020 PRINTTAB(T(4))SP$:GOTO300
1050 T(2)=T(2)+B
1055 IFT(2)=-1ORT(2)=16THENGOSUB1500:GOTO700
1060 PRINTTAB(T(2))T$:GOTO300
1090 T(1)=T(1)+B
1095 IFT(1)=-1ORT(1)=15THENGOSUB1500:GOTO700
1100 PRINTTAB(T(1))C$:GOTO300
1110 T(3)=T(3)-1
1120 IFT(3)<0THENGOSUB1500:GOTO700
1130 PRINTTAB(T(3))LA$:GOTO300
1500 PRINT"                                            ";
1505 PRINT"                             ":RETURN:REM CLEARS  SHIPS FROM  SCREEN
1510 GOSUB900:GOSUB1500
1515 PRINT"▒▒▒"SPC(T(E))"   ▞▜ ▀ ▛█                    ▒┌───────":REM SINKING SHIP
1517 REM BONUS POINTS
1520 IFI>T(E)+3THENSC=SC+(T(E)+6-I)*10:GOTO923
1530 SC=SC+(I-T(E))*10:GOTO923
2000 PRINT"▒▒▒**************************▒D>>>>>▒SUB-ATTACK▒K<<<<<";
2005 PRINT"▒**************************"
2010 PRINT"▒▒ BY STUART HALL.        ▒ 11,BEELEY CLOSE,"
2020 PRINT"▒ INKERSALL,              ▒ CHESTERFIELD,"
2030 PRINT"▒ DERBYS."
2040 FORX=1TO7000:NEXT
2050 PRINT"▒▒▒▒ DESTROY AS MANY ENEMY▒SHIPS AS POSSIBLE IN  ▒ONE MINUTE."
2060 K=1:GOTO110
2065 K=0
2070 PRINT"▒";C$;"▒ - 20 POINTS"
2080 PRINT"▒";T$;"▒  - 40 POINTS"
2090 PRINT"▒";LA$;"▒ - 60 POINTS"
2100 PRINT"▒";SP$;"▒     - 80 POINTS"
2102 PRINT"▒▒ + BONUS POINTS!"
2105 FORX=1TO7000:NEXT
2110 PRINT"▒▒ CONTROLS:"
2130 PRINT"▒ 'I' - MOVES LEFT"
2140 PRINT"▒ 'P' - MOVES RIGHT"
2150 PRINT"▒ 'O' - FIRES A MISSILE"
2160 PRINT"▒▒▒ PRESS A KEY TO START."
2165 POKE198,0
2170 GETR$:IFR$=""THEN2170
2180 GOTO10
```

B

ACK

RUNS ON A VIC 20 IN 3·5K

BY STUART HALL



RUNS ON A VIDEO GENIE

YAHTZEE

BY KEITH HOOK

Lady Luck presides over the popular dice game of Yahtzee but you make the calls, and the computer makes a worthy opponent.

For those not familiar with Yahtzee, it involves five dice but a good deal of skill and judgement as well as a fair slice of luck.

There is a poker type scorecard for each player with a list of things to be achieved and scored. The player throws the five dice and decides which section of the scoresheet that throw is dedicated to.

The scoresheet is made up of: ones, twos, threes, fours, fives, sixes, high run (2, 3, 4, 5, 6) and low run, four of a kind, three of a kind, two pair, a full house, a pair, a Yahtzee and a chance. Bonuses are scored for making a Yahtzee (five-of-a-kind) and scoring well on the first section: ones-sixes.

Say the player throws 2, 2, 2, 6, 5. He then has the choice of trying for: a three of a kind, threes on the lefthand side of the scoreboard or keeping the three twos and re-rolling the other two dice to achieve a four of a kind or a Yahtzee. Three throws is the limit before he fills in his scorecard.

If he is not successful in his two further throws he can still go in the first two options, if however, he fails to score any of the combinations, he scores 0 in one of the boxes.

The game involves a fair amount of strategy and the computer plays a fair game. But there is plenty of scope for improvement and all that is needed is to add to the data statements in lines 30000 through to 30140, or try adding further options to lines 7310; 7365; 7305; 7414.

Yahtzee is written for the Video Genie but it will work on a TRS-80 and, as there are no PEEK or POKE statements, the reader should have little difficulty in adapting the graphic part to other machines.

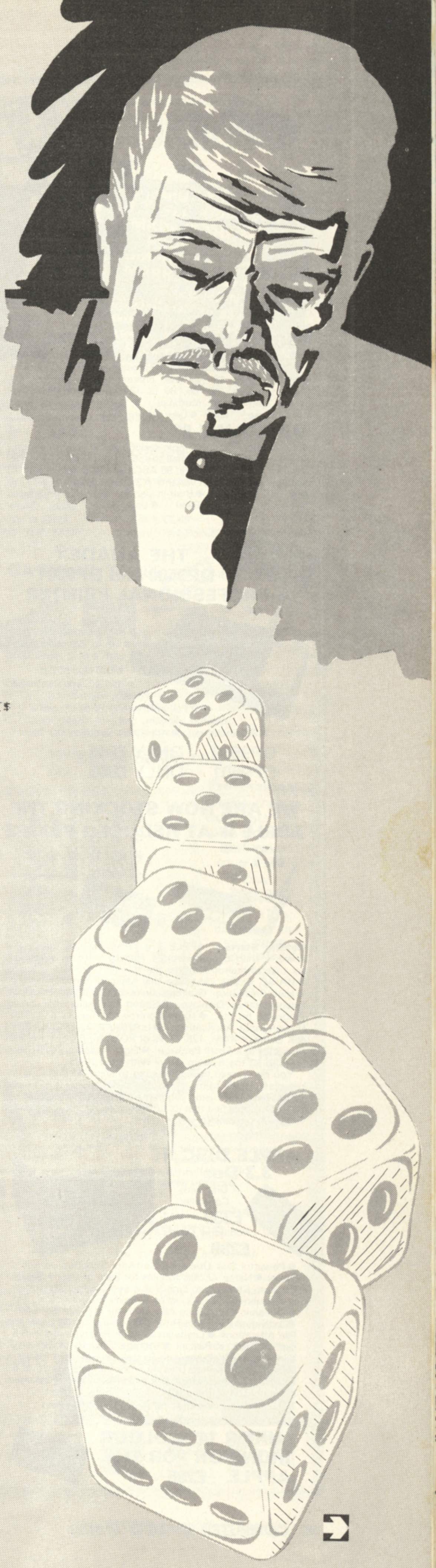
Arrays: x(15) is used to swop data when turns are transferred from computer to human; or vice versa.
H(15) Stores human scorecard.
CP(15) Stores computer scorecard.
t(5) Is for storing throw of dice.
z(3) Is used for storing 3 new throws by computer.

```
10 CLS:DEFINTA-Z:CLEAR500:RANDOM
20 DIMX(15),H(15),CP(15),T(5),K3(30),K4(30),FH(30),LS(14),M(14)
25 DIM HS(2),YH(6),J(2),JJ(28),K(18),KK(6),L(18),LL(5),Z(3)
30 DATA 1112,1113,1114,1115,1116,1222,2223,2224,2225,2226
31 DATA 1333,2333,3334,3335,3336,1444,2444,3444,4445,4446
32 DATA 1555,2555,3555,4555,5556,1666,2666,3666,4666,5666
33 FORI=1TO30:READK3(I):NEXT
40 DATA 11112,11113,11114,11115,11116,12222,22223,22224,22225,22226
41 DATA 13333,23333,33334,33335,33336,14444,24444,34444,44445,44446
42 DATA 15555,25555,35555,45555,55556,16666,26666,36666,46666,56666
43 FORI=1TO30:READK4(I):NEXT
50 DATA11122,11133,11144,11155,11166,11222,22233,22244,22255,22266
51 DATA11333,22333,33344,33355,33366,11444,22444,33444,44455,44466
52 DATA11555,22555,33555,44555,55566,11666,22666,33666,44666,55666
53 FORI=1TO30:READFH(I):NEXT
60 DATA11234,12234,12334,12344,12346,22345,23345,23445,23455
61 DATA 13456,33456,34456,34556,34566
62 FORI=1TO14:READLS(I):NEXT
70 DATA 12345,23456
80 FORI=1TO2: READHS(I):NEXT
110 DATA 11111,22222,33333,44444,55555,66666:FORI=1TO6:READYH(I):NEXT
111 GOSUB30000
130 C=0:GOTO 3700
140 CLS
150 IF AX<>1 PRINT@0, YS$+Z$ ELSE PRINTYS$
160 PRINT@64,"1. ACES    1+1+1 =  3.."TAB(23)X(1);TAB(26)"/";
170 PRINTTAB(28)" 9. 3 OF A KIND (TOTAL DICE) ";TAB(60) X(9)
180 PRINT@128,"2. TWO'S   2+2+2 =  6.." TAB(23)X(2);TAB(26)"/";
190 PRINTTAB(28)"10. 4 OF A KIND (TOTAL DICE) ";TAB(60) X(10)
200 PRINT@192,"3. THREES  3+3+3 =  9.."TAB(23)X(3);TAB(26)"/";
210 PRINTTAB(28)"11. FULL HOUSE (SCORE 25)"TAB(60)X(11)
220 PRINT@256,"4. FOURS   4+4+4 = 12.."TAB(23)X(4);TAB(26)"/";
230 PRINTTAB(28)"12. LOW STRAIGHT (SCORE 30)" TAB(60)X(12)
240 PRINT@320,"5. FIVES   5+5+5 = 15.."TAB(23)X(5);TAB(26)"/";
250 PRINTTAB(28)"13. HIGH STRAIGHT (SCORE 40)" TAB(60)X(13)
260 PRINT@384,"6. SIXES   6+6+6 = 18.."TAB(23)X(6);TAB(26)"/";
270 PRINTTAB(28)"14. Y A H T Z E E (SCORE 50)"TAB(60)X(14)
280 PRINT@448,"7. TOTAL (IF 63 +35)"TAB(23)X(7);TAB(26)"/";
290 PRINTTAB(28)"15. CHANCE   (TOTAL DICE)"TAB(60)X(15)
300 PRINT@512,"*GRAND TOTAL  (LEFT SCORE + RIGHT SCORE)................"TAB(59)X
(8)
310 FORI=0TO125:SET(I,27):NEXTI
320 RETURN
340 FOR I=1TO15:H(I)=1:CP(I)=1:NEXTI
369 FOR I=1 TO 15:X(I)=H(I):NEXT I:GOSUB140
370 PRINT@640,"YOUR THROW ";Z$;
380 PRINT TAB(26)"A    B    C    D    E";
390 PRINT@704,"YOUR SCORE ";Z$;
```

```
400 GOSUB 640:GOSUB1010
402 GOSUB691
403 IF X$<>"N"GOSUB691
410 PRINT@832,"WHICH SCORECARD DO YOU WANT TO USE L(EFT) OR R(IGHT) ? "
411 X$=INKEY$:IF X$=""GOTO411
420 IFX$="L" GOSUB 1300ELSE IFX$="R"GOSUB2000
421 GOSUB 140:GOSUB15000
432 FOR I=1 TO 15:H(I)=X(I):NEXT I
433 IFX(7)<>1 ANDX(8)<>1THEN434 ELSE440
434 FORI=1TO1000:NEXTI:H(8)=X(8):GOTO4068
440 FORI=1TO2000:NEXTI:C=C+1:GOTO7140
640 REM GOSUB THROW
650 FOR I= 1TO 5:T(I)= RND(6):NEXT I
651 GOSUB 16000
660 RETURN
691 PRINT@832,STRING$(64," "):PRINT@832,"DO YOU WANT TO CHANGE ANY NUMBER ?"
692 X$=INKEY$
693 IF X$=""GOTO692
694 IF X$="N" THEN RETURN ELSEIFX$<>"Y" GOTO692
695 PRINT@832,"HOW MANY NUMBERS DO YOU WANT TO CHANGE ";:INPUTQ:IFQ<1 ORQ>5GOTO6
95
696 PRINT@832,STRING$(64," "):ON Q GOTO697,699,701,703,705
697 PRINT@832,"WHICH NUMBER DO YOU WANT TO CHANGE";:INPUTY$
698 GOTO780
699 PRINT@832,"WHICH TWO NUMBERS DO YOU WANT TO CHANGE";:INPUTY$,YY$
700 GOTO780
701 PRINT@832,"WHICH 3 NUMBERS DO YOU WANT TO CHANGE";:INPUTY$,YY$,K$
702 GOTO780
703 PRINT@832,"WHICH 4 NUMBERS DO YOU WANT TO CHANGE";:INPUTY$,YY$,K$,KK$
704 GOTO780
705 FOR I=1TO5:T(I)=RND(6):NEXTI:GOTO 903
780 IF Y$="A"Y=1
790 IF Y$="B"Y=2
800 IFY$="C"Y=3
810 IFY$="D"Y=4
820 IFY$="E"Y=5
821 T(Y)=RND(6):IFQ=1GOTO903
830 IFYY$="B"YY=2
840 IFYY$="C"YY=3
850 IFYY$="D"YY=4
860 IFYY$="E"YY=5
861 T(YY)=RND(6):IFQ=2GOTO903
```

```
870 IFK$="C"Z=3
880 IFK$="D"Z=4
890 IFK$="E"Z=5
891 T(Z)=RND(6):IFQ=3GOTO903
900 IFKK$="D"ZZ=4
901 IFKK$="E"ZZ=5
902 T(ZZ)=RND(6)
903 GOSUB16000
920 Y$="#":YY$="#":K$="#":KK$="#":Y=0:YY=0:Z=0:ZZ=0
1000  PRINT@704,"yOUR SCORE ";Z$;
1010 PRINTTAB(25)T(1);TAB(30)T(2);TAB(35)T(3);TAB(40)T(4);TAB(45)T(5)
1020 RETURN
1300 GOSUB 16000
1310 SC=(T(1)*10[3)+(T(2)*10[2)+(T(3)*10)+T(4)
1320 FOR I=1TO30:IFINT(SC)=INT(K3(I))THEN1380 ELSE NEXTI
1321 SC=T(2)*10[3+(T(3)*10[2)+(T(4)*10)+T(5)
1322 FOR I=1TO30:IFINT(SC)=INT(K3(I))THEN1380 ELSE NEXTI
1323 IF AX=1 RETURN
1330 PRINT@832,STRING$(64," "):PRINT@832,"SORRY !! ";Z$;" YOU MUST SCORE 0  WHIC
H BOX";:INPUT I
1340 IFI>6THEN1330
1350 IFX(I)<>1THEN PRINT@832,STRING$(64," "):PRINT@832,"CHEAT !! YOU'VE USED THA
T BOX":FOR I=1TO500:NEXTI ELSE1370
1360 GOTO1330
1370 X(I)=0:RETURN
1380 IFT(3)=1THENX(1)=3
1381 IFT(3)=2THENX(2)=6
1382 IFT(3)=3THENX(3)=9
1383 IFT(3)=4THENX(4)=12
1384 IFT(3)=5THENX(5)=15
1385 IFT(3)=6THENX(6)=18
1386 RETURN
2000 REM
2011 SC=T(1)*10[4+(T(2)*10[3)+(T(3)*10[2)+(T(4)*10)+T(5)
2021 FORI=1TO6:IF INT(SC)=INT(YH(I))THENAL=1:GOTO2067ELSENEXTI
2031 FORI=1TO2:IFINT(SC)=INT(HS(I))THENAL=3:GOTO2067ELSE NEXTI
2041 FORI=1TO14:IFINT(SC)=INT(LS(I))THENAL=4:GOTO2067ELSENEXTI
2051 FOR I=1TO30:IF INT(SC)=INT(FH(I))THENAL=2:GOTO2067ELSENEXTI
2061 FOR I= 1TO30:IF INT(SC)=INT(K4(I))THENAL=5:GOTO2067ELSENEXTI
2062 SC=(T(1)*10[3)+(T(2)*10[2)+(T(3)*10)+T(4)
2063 FOR I=1TO30:IF INT(SC)=INT(K3(I))THENAL=6:GOTO2067ELSENEXTI
2064 SC=(T(2)*10[3)+(T(3)*10[2)+(T(4)*10)+T(5)
2065 FOR I=1TO30:IF INT(SC)=INT(K3(I))THENAL=6:GOTO2067ELSENEXTI
2066 AL=7
2067 IFAX=1THEN RETURNELSE ONAL GOTO3030,3080,3110,3150,3190,3240,3290
3030 PRINT@896,"DO YOU WANT  ' YAHTZEE ' ";Z$;:INPUTI$
3040 IF LEFT$(I$,1)="N" THEN 3190
3050 IF X(14)=1 THEN X(14) = 50 ELSEX(14)=XX(14)+100
3060 GOTO3351
3080 IFX(11)<>1THEN3240 ELSE PRINT@896,"DO YOU WANT ' FULL HOUSE ' ";Z$;:INPUTI$

3090 IFLEFT$(I$,1)="N"THEN3240 ELSE X(11)=25
3100 GOTO3351
3110  IF X(13)<>1 THEN 3150
3120 PRINT@896,"DO YOU WANT ' HIGH STRAIGHT ' ";Z$;:INPUTI$
3130 IF LEFT$(I$,1)="N" THEN 3150 ELSEX(13)=40
3140 GOTO3351
3150  IF X(12)<>1 GOTO 3290
3160 PRINT@896,"DO YOU WANT ' 10W STRAIGHT ' ";Z$;:INPUTI$
3170 IF LEFT$(I$,1)="N" THEN 3290 ELSE X(12)=30
3180 GOTO3351
3190  IF X(10)<>1 GOTO3240
3200 PRINT@896,"DO YOU WANT ' 4 OF A KIND ' ";Z$;:INPUTI$
3210 IFLEFT$(I$,1)="NO" THEN3240
3220 X(10)=0:FOR I=1 TO 5:X(10)=X(10)+T(I):NEXTI
3230 GOTO3351
3240  IF X(9)<>1 GOTO3290
3250 PRINT@896,"DO YOU WANT' 3 OF A KIND ' ";Z$;:INPUT I$
3260 IF LEFT$(I$,1)="N" THEN 3290
3270 X(9)=0:FORI=1TO5:X(9)=X(9)+T(I):NEXT I
3280 GOTO3351
3290 IFX(15)<>1 GOTO3340
3300 PRINT@896,"DO YOU WANT 'CHANCE ' ";Z$;:INPUTI$
3310 IF LEFT$(I$,1)="N" THEN 3340
3320 X(15)=0:FOR I=1TO5:X(15)=X(15)+T(I):NEXT
3330 GOTO3351
3340  PRINT@896,"SORRY ";Z$;" YOU MUST SCORE 'ZERO'' WHICH BOX";:INPUT I
3341 IF I<9ORI>15 THEN3340
3350 X(I)=0
3351 RETURN
3700 PRINT@0,"COPYRIGHT K.HOOK,
3,BULCOCK STREET,
BURNLEY, 57427
3705 FOR I= 1 TO 1000:NEXT:CLS
3710 PRINT@448,"THIS IS THE GAME OF ' Y A H T Z E E '"
3715 PRINT@512,"IT IS BASED ON 'MILTON BRADLEY LTD' VERSION OF THE RULES."
3716 FOR I= 1 TO 1000:NEXT
3720 PRINT@832,"PRESS ' NEW LINE ' TO CONTINUE.....":INPUT W
3725 CLS:INPUT"DO YOU NEED INSTRUCTIONS........";I$
3730 IF LEFT$(I$,1)="N" GOTO3810
3735 IF RIGHT$(I$,1)<>"Y" THEN 3725
3740 CLS:PRINT@512,TAB(18) "Y A H T Z E E"
3745 PRINT@896,"THE RULES WILL FOLLOW.........."
3750 FOR I = 1 TO 500:NEXT I
3751 CLS:PRINT@0,TAB(18)" Y A H T Z E E "
3755 PRINT"THE OBJECT OF THE GAME IS TO OBTAIN THE HIGHEST SCORE."
3760 PRINT"THE PLAYER WITH THE HIGHEST TOTAL SCORE WINS."
3765 PRINT"yOU ARE PLAYING AGAINST THE COMPUTER, BUT THE COMPUTER WILL"
3770 PRINT"KEEP AN EVER WATCHFUL EYE ON YOUR MOVES. IT WILL NOT LET YOU"
3775 PRINT"CHEAT."
3780 PRINT"THE SCOREBOARD IS DIVIDED INTO TO HALVES LEFT AND RIGHT."
3785 PRINT"YOU ARE ALLOWED THREE THROWS IN ANY ONE GO AND THE POINTS"
3790 PRINT"AWARDED ARE SELF EXPLANATORY."
3795 PRINT"'FULL HOUSE' IS :-'11155' ETC."
3796 PRINT:PRINT
3800 PRINT"PRESS 'NEW LINE' TO CONTINUE...":INPUTW
3810 CLS:PRINT@512,"WHAT IS YOUR NAME":INPUT Z$
3815 CLS:PRINT@448,"THANK YOU ";Z$
3820 PRINT@512,TAB(20) "MY NAME IS GEANy"
3825 FOR I=1TO 1000:NEXT
3830 YS$="THIS YOUR SCORE CARD ":GOTO340
```



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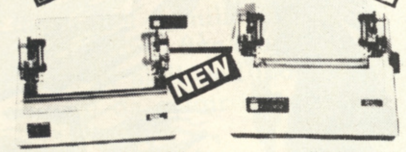

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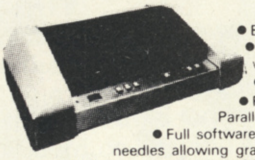

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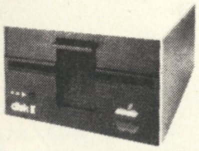

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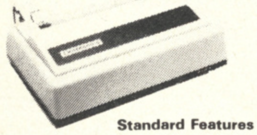

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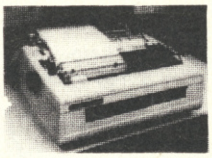

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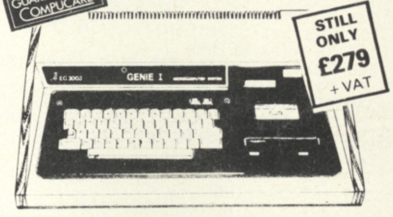

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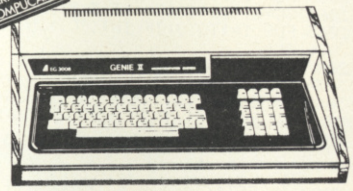

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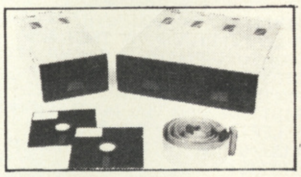

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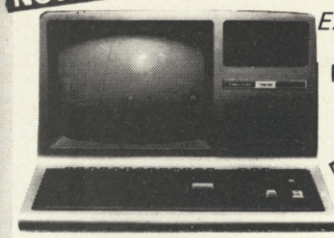

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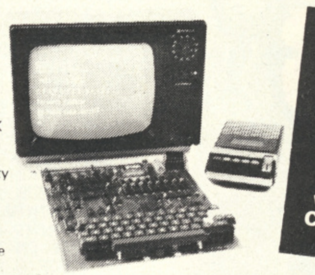

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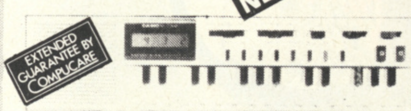

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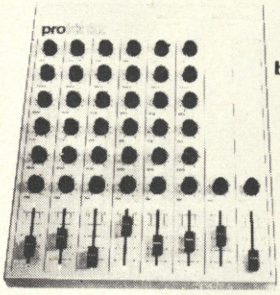

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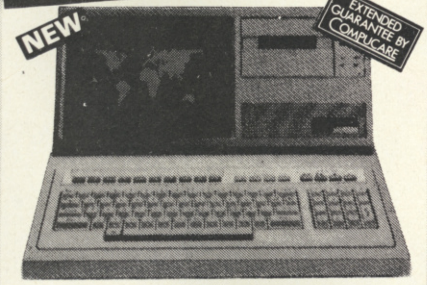

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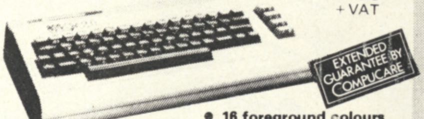

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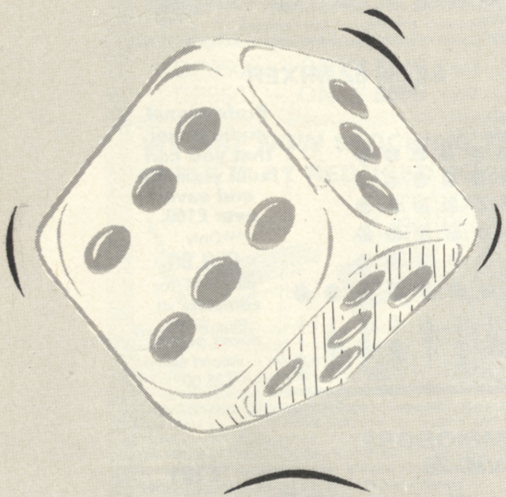
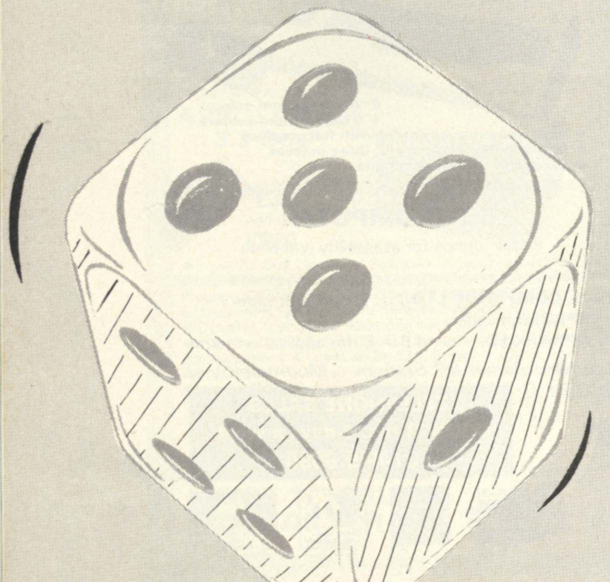


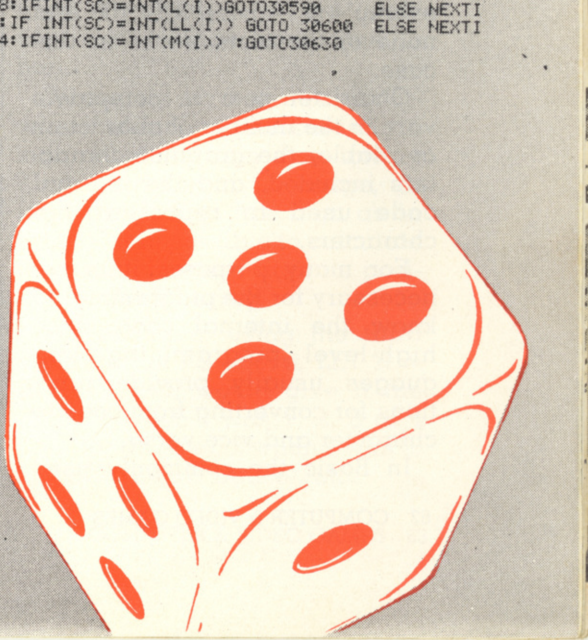


```
4068 REM
4069 IFH(7)=1THENFOR I=1TO6:H(7)=H(7)+H(I):NEXTI
4078 IFH(8)=1THENFORI=9TO15:H(8)=H(8)+H(I):NEXTI:H(8)=H(8)+H(7)
4098 IFCP=1THEN FORI=1TO6:CP(7)=CP(7)+CP(I):NEXTI
4108 IFCP(8)=1THENFORI=9TO15:CP(8)=CP(8)+CP(I):NEXTI:CP(8)=CP(8)+CP(7)
4128 CLS:PRINT@448,TAB(20)"YOUR SCORE ";Z$,H(8)
4138 PRINT@512,TAB(20)"MY SCORE ";Z$,CP(8)
4139 FORI=1TO2000:NEXTI
4148 IFCP(8)>H(8)THENB$="I'VE WON !! " ELSEB$="YOU'VE WON THIS TIME ! "
4158 CLS: PRINT@512,TAB(20) B$+Z$:FOR I=1TO1000:NEXTI:CLS
4178 PRINT@512,"DO YOU WANT ANOTHER GAME ";Z$
4188 INPUTI$
4198 IFLEFT$(I$,1)="Y" GOTO340
4208 IFLEFT$(I$,1)<>"N"GOTO4178
4218 CLS:PRINT@512,"O.K. CHICKEN ! !": FOR I = 1 TO 500:NEXT
4228 CLS:PRINT@512,"GOODBYE ";Z$:FOR I= 1 TO 1000:NEXT:CLS
4238 END
7000 YS$="THIS IS MY SCORE CARD......"
7010 GOSUB 140
7020 PRINT@640,"IT'S MY THROW ";Z$;
7030 PRINT TAB(26)"A    B    C    D    E"
7040 IF CM<>0GOTO7080
7050 FOR X = 52TO89:FOR X1=52TO89STEP3
7060 SET(X,34):RESET(X1,34):NEXTX1,X
7070 FORX=52TO91:RESET(X,34):NEXTX
7080 PRINT@704,"MY SCORE "; Z$;
7090 PRINTTAB(25)T(1);TAB(30)T(2);TAB(35)T(3);TAB(40)T(4);TAB(45)T(5)
7091 PRINT@832,STRING$(64," ")
7100 RETURN
7140 CM=0:CC=1:T=0:AX=1:IFC<>1THEN7160
7150 FORI=1TO15:X(I)=1:NEXTI
7160 FORI=1TO15:X(I)=CP(I):NEXT I
7170 GOSUB640:GOSUB16000:GOSUB7000
7180 CM=1:T=T+1
7181 PRINT@832,"I'M THINKING ";Z$:FORI=1TO1000:NEXTI
7182 GOSUB2000
7187 ON AL GOTO7190,7220,7270,7290,7305,7365,7435
7190 IF X(14) =1 GOTO 30700
7195 IFX(10)=1 GOTO 30780
7200 IFX(9)=1 GOTO 30800
7205 IF X(9)<>1 AND X(10)<>1ANDX(12)<>1ANDX(13)<> 1GOTO 30700
7210 B$="A & b "
7215 GOTO30200
7220 REM FULL HOUSE
7225 IFX(11)=1 GOTO 30760
7230 IFX(9)=1 GOTO 30800
7235 IF T(1)=T(3) THEN W=T(1)
7240 IFX(W)=1 GOTO 7500
7245 IF T(5)=T(3) W=T(5)
7250 IFX(W)=1 GOTO 7500
7255 IFT(1)=T(3) B$="D & E "
7260 IFT(5)=T(3) B$="A & B "
7265 GOTO 30200
7270 REM
7275 IFX(13)=1 GOTO 30720
7280 IFX(12)=1 GOTO 30740
7285 GOTO 30509
7290 REM
7295 IF X(12)= 1 GOTO 30740
7300 GOTO 8009
7305 REM FOUR OF A KIND
7310 IFX(10)=1 GOTO30780
7311 IFT=3THEN7315
7312 IFX(14)=1 ANDT(1)=T(4)B$="E"ELSEB$="A":GOTO30200
7315 IFX(9)=1GOTO 30800
7320 IFT(1)=T(4) THEN W=T(1)
7325 IFX(W)=1 GOTO 7500
7330 IFT(5)=T(2) THEN W=T(5)
7335 IFX(W)=1 GOTO 7500
7340 IFX(11)=1 GOTO7350
7345 GOTO7480
7350 IFT(1)=T(4) B$="D & E "
7355 IF T(5)=T(2) B$="A & B "
7360 GOTO30200
7365 REM3 OF A KIND
7370 IF X(9)=1 GOTO 30800
7375 IFT(1)=T(3) THENW=T(1)
7380 IF X(W) =1 GOTO 7500
7385 IFT(5)=T(3) THEN W=T(5)
7390 IFX(W)=1GOTO  7500
7395 IFT(2)=T(4)THEN W=T(4)
7400 IFX(W)=1 GOTO 7500
7405 IFX(11)=1GOTO7420
7410 IFX(10)=1 GOTO7420
7411 IF T(1)=T(3)B$="A B C "
7412 IFT(5)=T(3)B$="C D E "
7413 IFT(2)=T(4)B$="B C D "
7414 GOTO30200
7420 IFT(1)=T(3) B$="D & e "
7425 IFT(5)=T(3) B$="A & B "
7430 IFT(2)=T(4) B$="A & e "
7431 GOTO30200
7435 REM CHANCE
7440 X=0:IF T<>3 GOTO7450
7445 IFX(15)=1 GOTO 30821 ELSE 7550
7450 FOR I=9TO14:IFX(I)=1 THEN X=X+1ELSENEXTI
7455 IF X=0 ANDX(15)=1 GOTO 30821 ELSE 30509
7480 REM CHANGE ALL DICE
7485 IFT=3 GOTO 7550ELSEPRINT@832,"I'M CHANGING ALL THE DICE ";Z$;
7490 FOR I=1TO 5:T(I)=RND(6):NEXTI
7495 GOSUB16000:GOSUB7080:GOTO7180
7500 X(W)=W:REM LEFT SSCRCRD
7505 ON X(W) GOTO 7510,7515,7520,7525,7530 ,7535
7510 X(1)=3:B$="ONES":GOTO7540
7515 X(2)=6:B$="TWOS":GOTO7540
7520 X(3)=9:B$="THREES":GOTO7540
7525 X(4)=12:B$="FOURS":GOTO7540
7530 X(5)=15:B$="FIVES":GOTO7540
```

```
7535 X(6)=18:B$="SIXES":GOTO7540
7540 PRINT@832,"I'M GOING LEFT ";Z$;" INTO ";B$:FORI=1TO500:NEXT
7545 GOSUB7000:GOTO 30840
7550 REMZERO
7555 PRINT@832,"i'LL HAVE TO SCORE ZERO THIS TIME ";Z$
7560 FOR I= 1TO 6:IF X(I)=1 THENX(I)=0:GOTO30840 ELSE NEXT I
7565 FOR I=9TO 15:IFX(I)=1 THEN X(I)=0:ELSE NEXT I
7570 GOTO30840
8009 REM DATAONE
8010 IFX(13)<>1GOTO8016
8011 IFT(1)=T(2) B$="A":GOTO8021
8012 IFT(2)=T(3) B$="C":GOTO8021
8013 IFT(3)=T(4) B$="D":GOTO8021
8014 IFT(4)=T(5) B$="E":GOTO8021
8015 GOTO7480
8016 IFT(2)=T(3)B$="A D E ":GOTO8021
8017 IFT(3)=T(4)B$="A B E ":GOTO8021
8018 IFT(4)=T(5)B$="A B C ":GOTO8021
8019 IFT(1)=T(2)B$="C D E ":GOTO8021
8020 GOTO7480
8021 GOTO30200
15000 IFX(7)<>1 GOTO15006ELSEFORI=1TO6:IFX(I)=1GOTO15006 ELSE NEXTI
15001 AA=10:FOR I=1TO6:AA=AA+X(I):NEXTI
15002 IF AA=16 GOTO15006
15003 X(7)=0:FORI=1TO6:X(7)=X(7)+X(I):FOR J=1TO10
15004 PRINT@448,"TOTAL   (IF 63  +35)";TAB(23)X(7);:NEXTJ,I
15005 IFX(7)=63 THENX(7)=98;
15006 IFX(8)<>1 RETURNELSE FOR I=9TO15:IF X(I)=1 THEN RETURN ELSE NEXT I
15007 FF=10:FORI=9TO15:FF=FF+X(I):NEXTI
15008 IF FF=16 RETURN
15009 X(8)=0:FOR I=9TO15:X(8)=X(8)+X(I):FORJ=1TO10
15010 PRINT@512,"GRAND TOTAL   (LEFT PLUS RIGHT).....................";TAB(59)X(8);
:NEXTJ,I
15011 IFX(7)<>1ANDX(8)<>1THENX(8)=X(8)+X(7):FORI=1TO1000:NEXT I
15012 RETURN
16000 FORX=1TO5:FORY=2TO5
16010 IFT(Y)>T(Y-1)THEN16030
16020 Z=T(Y):T(Y)=T(Y-1):T(Y-1)=Z
16030 NEXTY
16040 NEXTX
16050 RETURN
30000 K=K+1:IFK<>1RETURN:DATA 11235,11236
30010 FORI=1TO2:READ J(I):NEXT
30020 DATA11223,11224,11225,11226,11334,11335,11336,11445,11446,11556
30021 DATA11226,11336,11446,11556,22336,22446,22556,33446,33556,44556,24566,3456
6,23566,13466,14566,13455,12455,12356
30030 FORI=1TO28:READJJ(I):NEXTI
30040 DATA11233,11244,11255,11266,11344,11355,11366,11455,11466
30050 DATA11566,22344,22455,22355,22366,33455,33466,33566,44566
30060 FORI=1TO18:READK(I):NEXTI
30070 DATA12235,12236,13356,23356,23346,24456
30080 FORI=1TO6:READKK(I):NEXTI
30090 DATA12233,12244,12255,12266,13344,13355,13366,14455,14466
30100 DATA15566,23355,23344,23366,24455,24466,34455,35566,45566
30110 FORI=1TO18:READL(I):NEXTI
30120 DATA12355,12356,12366,23566,23556
30130 FORI=1TO5:READLL(I):NEXTI
30131 DATA11332,11335,11334,11336,11226,11225,11224,11223
30132 DATA22334,22335,22336,33446,33445,44556
30133 FORI=1TO14:READM(I):NEXT
```

```
30140 RETURN
30200 REM RETHROW
30201 IF T=3 GOTO7550
30210 Z(1)=RND(6):Z(2)=RND(6):Z(3)=RND(6)
30220 IF B$="A" T(1)=Z(1):GOTO30350
30230 IFB$="C"T(3)=Z(1):GOTO30350
30240 IFB$="D"T(4)=Z(1):GOTO30350
30241 IFB$="B"T(2)=Z(2):GOTO30350
30250 IFB$="E"T(5)=Z(1):GOTO30350
30251 IFB$="B & E " T(2)=Z(2):T(5)=Z(3):GOTO30350
30260 IFB$="C D E " T(3)=Z(3):T(4)=Z(2):T(5)=Z(1):GOTO30350
30261 IFB$="B C D "T(2)=Z(1):T(3)=Z(2):T(4)=Z(3):GOTO30350
30270 IFB$="A D E "T(1)=Z(1):T(4)=Z(2):T(5)=Z(3):GOTO30350
30280 IFB$="A B E "T(1)=Z(1):T(2)=Z(2):T(5)=Z(3):GOTO30350
30290 IFB$="A B C "T(1)=Z(1):T(2)=Z(2):T(3)=Z(3):GOTO30350
30300 IFB$="A & B "T(1)=Z(1):T(2)=Z(2):GOTO30350
30310 IFB$="D & e "T(1)=Z(1):T(5)=Z(2):GOTO30350
30311 IFB$="A & C "T(1)=Z(1):T(3)=Z(2):GOTO30350
30312 IFB$="A & E "T(1)=Z(1):T(5)=Z(2)
30350 PRINT@832,"I'M CHANGING ";B$;" ";Z$:FOR I=1TO1000:NEXTI
30351 GOSUB16000:GOSUB7080:GOTO7180
30509 REM DATA SORT
30510 SC=T(1)*10[4+(T(2)*10[3)+(T(3)*10[2)+(T(4)*10)+T(5)
30520 FORI=1TO2:IFINT(SC)=INT(J(I))GOTO30580ELSENEXTI
30530 FORI=1TO10:IFINT(SC)=INT(JJ(I)) GOTO30600   ELSE NEXTI
30540 FORI=1TO18:IFINT(SC)=INT(K(I)) GOTO30610    ELSE NEXTI
30550 FOR I=1TO6:IFINT(SC)=INT(KK(6))GOTO30620    ELSE NEXTI
30560 FORI=1TO18:IFINT(SC)=INT(L(I))GOTO30590     ELSE NEXTI
30570 FORI=1TO5:IF INT(SC)=INT(LL(I)) GOTO 30600  ELSE NEXTI
30571 FORI=1TO14:IFINT(SC)=INT(M(I)) :GOTO30630
```

```
30580 IFT<>3GOTO30590
30581 IFX(15)<>1 GOTO7550 ELSE30821
30590 B$="A":GOTO30200
30600 B$="E":GOTO30200
30610 B$="C":GOTO30200
30620 B$="B":GOTO30200
30630 B$="A & C ":GOTO30200
30631 GOTO30200
30700 IFX(14)=1 THEN X(14)=50 ELSEX(14)=X(14)+100
30710 PRINT@832,"i'M GOING FOR YAHTZEE !! ";Z$:GOTO30840
30720 X(13)=40
30730 PRINT@832,"i'M IN FOR HIGH STRAIGHT ";Z$:GOTO30840
30740 X(12)=30
30750 PRINT@832,"i'VE GOT LOW STRAIGHT THIS TIME "; Z$:GOTO30840
30760 X(11)=25
30770 PRINT@832,"FULL HOUSE ";Z$;" I'M PLEASED ABOUT THAT !":GOTO30840
30780 X(10)=0:FORI=1TO5:X(10)=X(10)+T(I):NEXTI
30790 PRINT@832,"MANAGED FOUR OF A KIND "; Z$:GOTO30840
30800 X(9)=0:FOR I=1TO5:X(9)=X(9)+T(I):NEXTI
30810 PRINT@832,"THREE OF A KIND ";Z$:GOTO30840
30820 IFX(15)<>1GOTO30831
30821 X(15)=0:FORI=1TO5:X(15)=X(15)+T(I):NEXT
30830 PRINT@832,"PHEW !! JUST MADE CHANCE THIS TIME ": Z$:GOTO30840
30840 FOR I=1TO 1000:NEXT I:REM END BIT
30850 GOSUB7000:GOSUB15000
30860 IF X(7)<>1 AND X(8)<>1 THENCP(8)=X(8):GOTO4068
30870 FORI=1TO 15:CP(I)=X(I):NEXTI
30880 FORI=1TO1000:NEXTI
30890 AX=0:T=0:CC=0
30891 YS$="THIS IS YOUR SCORE CARD "
30900 GOTO369
```



PRACTICAL PRACTICAL PRACTICAL PROGRAMMING

By TED BALL

MANIPULATING YOUR DATA

An important part of designing a program is deciding exactly how data is to be represented and organised.

The same data may be represented and organised in many different ways, and a particular form will allow some operations to be performed more easily than others.

For example, arithmetic of any kind is very difficult with Roman numerals, but much easier with modern positional notation, and in positional notation the choice of base makes a difference to some operations.

The simplest and best known example is the way in which we can multiply or divide by 10 in base 10 by shifting the digits left or right relative to the decimal point, while in base 2 the same operations give a multiplication or division by 2.

A less familiar example is found in tests for divisibility. Some commonly used tests are that a number is divisible by 2 if its last digit is divisible by 2, divisible by 3 if the sum of its digits is divisible by 3, and divisible by 9 if the sum of its digits is divisible by 9. However, these tests rely on the number being written in base 10 and will not necessarily work if the number is written in any other base; for example 9 in base 3 is 100 and none of the tests works in this case.

Character sets in computers vary in the number of characters available, the graphics characters included, and the internal code used to represent the characters.

For many purposes it is not necessary for the programmer to know the internal code since high-level programming languages usually provide functions for converting from code to character and vice versa.

In Basic the commonly used functions are ASC ("x") or CODE ("x") which gives the code for the character x, and CHR$(N) which gives the character corresponding to the code number N.

In some machines the same code gives different results according to how it is used; for example, on the PET PRINT CHR$ (N) and POKE S, N where S is a location on the screen, do not generally produce the same character.

In programming it is always best to use methods that do not depend on special features of the machine, as this will make your programs easily transportable.

The following program for converting numbers to hexadecimal (base 16) demonstrates a method that is often used for calculating the character code corresponding to the digits of a hexadecimal number.

```
100 PRINT "DECIMAL NUMBER";
110 INPUT N
200 LET N1 = N
210 LET H$ =""
220 LET Q = INT (N1/16)
230 LET D = N1 — 16*Q
240 LET A = D + 48
250 IF A > 57 THEN LET A = A + 7
260 LET H$ = CHR$ (A) + H$
270 IF N1 < 16 THEN GOTO 300
280 LET N1 = Q
290 GOTO 220
300 PRINT N; "IN DECIMAL IS"; H$; "IN HEX"
310 GOTO 100
```

Lines 220 and 230 give D equal to the remainder after dividing N1 by 16; which is the value of the rightmost digit in the hexadecimal form. Lines 240 and 250 give A equal to the ASCII code for D.

In the ASCII code the digits 0 to 9 are coded as the numbers 48 to 57, and the letters A to Z are coded as 65 to 90; thus adding 48 to D gives the correct ASCII code if 0<=D<=9, but if 10<=D<= 15 it is necessary to add another 7 to get the ASCII code for a letter from A to F.

This method is machine-dependent, as it makes use of specific ASCII codes, and while it will work on most home computers it will not work on all of them. The Sinclair machines, for example, do not use the ASCII codes. However, it is easy to convert the program so that it does not depend on the particular code used to represent the characters. If we add:

```
10 LET C$ = "0123456789ABCDEF"
240 LET H$ = MID$ (C$, D+1, 1) + H$
```

and delete lines 250 and 260 the program will work on any machine with Microsoft Basic regardless of the character code used. It still will not work on a Sinclair ZX81 as Sinclair BASIC does not have the MID$ function. However, in Sinclair Basic line 240 can be replaced by

```
240 LET H$ = C$(D+1) + H$
```

DEFINING CODES . . .

What we are doing in the second method is, in effect, defining our own code so that the code used in the machine is irrelevant to the working of the program.

In most applications we have to define our own representation for the data because the machine does not provide exactly what we want.

As an example, consider the problems of representing playing cards in a program. Some home computers have graph symbols for the suits but others do not; in the latter case we can use the letters C,D,H,S, as easily remembered abbreviations.

A card-playing program will have to accept cards input from the keyboard, perform various operations on the cards, and display cards on the screen, and these three phases may require entirely different representations of the cards and hence require conversion between the different representations.

For example a card may be typed in as CA, held as the number 14 for calculations concerning the play, and displayed on the screen as a picture of the Ace of Clubs.

The programmer will have little choice in the input and output forms as these must be easily recognised by the user, but the internal form may be chosen in many ways differing in both representation and organisation.

The choice of an internal form suitable for the operations that must be carried out can make a great difference to the ease or difficulty with which the program is designed and coded.

STORING CARDS . . .

One method of storing cards which simplifies many operations is to use a string array in which the array elements are the input forms and the array indices are used either as numeric codes for the cards or as pointers to another array giving numeric codes.

For example, we could define a string array P$(52) with P$(1)="CA", P$(2)="C2", . . . , P$(13)="CK",P$(2)="DA", . . ., P$(52)="SK".

We can then use a simple routine to check that what the player has typed in is actually a valid card:

```
100 INPUT C$
110 LET I = 1
120 IF C$ = P$(I) THEN GOTO
200
130 LET I = I + 1
140 IF I< 53 THEN GOTO 120
150 PRINT "NOT A VALID CARD,
TRY AGAIN"
160 GOTO 100
200 . . .
```

If the program began by dealing the player's hand we must also check that the card he typed in was included in the hand he was dealt.

On exiting the above routine I points to the array element corresponding to the card typed in, which with P$ as defined means that the cards are coded as CA=1, C2=2, etc.

This simple method of obtaining a numeric code may be all that is needed for some purposes. For example, to sort a hand we can simply sort the codes into ascending order and when we convert the codes to strings by looking up the P$ array we will find all cards of the same suit together and in order from Ace low to King high.

Other orders can be catered for by defining P$ differently. If we want the cards sorted into suits and in order from two low to Ace high we define P$(1)="C2", P$(2)="C3", . . . , P$(12)="CK", P$(13)="CA", P$(14)="D2", . . . ; if we want the hand sorted with cards of the same rank together regardless of suit we define P$(1)="CA", P$(2)="DA", P$(3)="HA", P$(4)="SA", P$(5)="C2", etc.

In many card games we will need to separate the suit and value of a card, and possibly perform some manipulations with the value.

If we store the cards in an array such as P$ the suit can be found easily as S$ = LEFT$ (P$(I), 1) and a numeric code can be devised from this if necessary.

It is usually more complicated to deal with the rank or value of the cards; it is rare to find a card game that requires any operation on the suits other than ordering or testing for equality, and sometimes for colour. However, different card games require a wide range of operations to be carried out on the ranks or values of the cards and there are frequently special cases.

GAMES YOU CAN PLAY

If we look at a few games we can see some of the necessary operations and special cases that affect the suitable representations of the cards.

CRIBBAGE

Points are scored for cards in sequence, with 10, J,Q,K entering into sequences in that order, so it would appear that these cards can be given a value of 10, 11, 12, 13 respectively. However, points are also scored for combinations of cards totalling 15 and in this case 10, J, Q and K all count as 10. Thus we need a different representation for J, Q, K according to what we are doing.

POKER

A run of five cards may have an Ace as the high card or the low card, but cannot have an Ace in the middle. Thus, A, 2, 3, 4, 5 and 10, J, Q, K, A count as runs, but J, Q, K, A, 2 does not. However, elsewhere in the game Ace is always high. Probably the easiest way of dealing with this anomaly is to include a special test for runs of the type A, 2, 3, 4, 5.

BLACK JACK

The aim of the game is to get the highest total without going over 21, where 2 to 10 count as the spot value, J, Q, K count 10, and A may count as either 1 or 11 as the player wishes. In evaluating a hand it is necessary to allow for the two different values that may be assigned to an Ace.

BRIDGE

In the bidding the suits rank from low to high, Clubs, Diamonds, Hearts, Spades, No Trumps. In the play, however, there may be a trump suit, in which case a card of the trump suit ranks above cards of any other suit whenever it is played in a trick. To allow for this we need a valuation of the cards that may change from hand to hand.

Where we have a straightforward ordering of the cards in a suit, whether from Ace low to King high as in Cribbage, or from two low to Ace high as in Bridge, it is possible to calculate the rank of a card from its position in the P$ array.

For example, using the third definition of P$ above, LET R = INT((I+3) /4) would give R the value 1 when I was 1, 2, 3 or 4 (i.e., for an Ace), 2 when I was 5, 6, 7 or 8 (i.e., a Deuce), etc.

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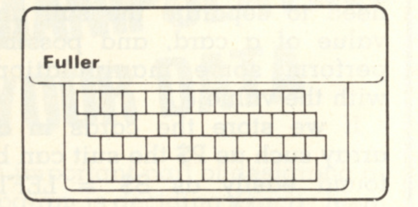

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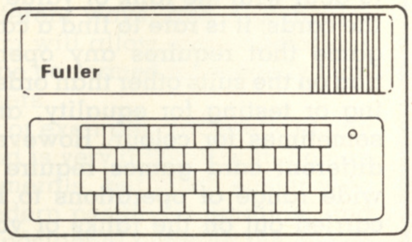

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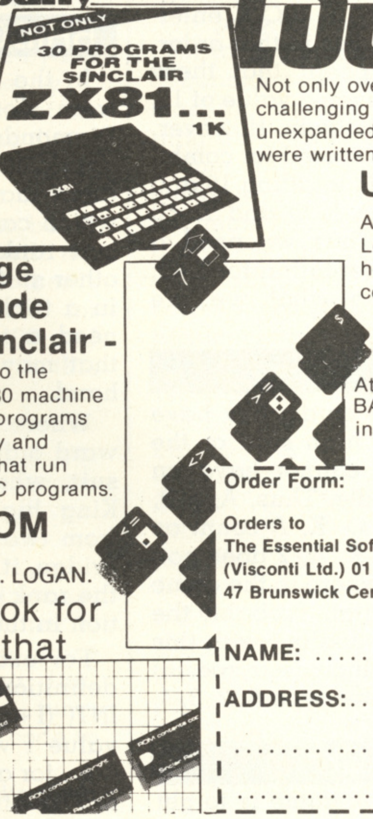

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american DREAMS

ULTIMATE ULTIMAX

In Las Vegas everybody's talking about the Ultimax, Commodore's new games machine. This $149.95 system has a higher specification than the VIC-20, which is twice the price. We can expect it in Europe in the summer with a price tag of around £99.

The Ultimax is a programmable colour computer which connects directly to the TV. It has a membrain keyboard, like the ZX81, and can be programmed in Basic. It uses both plug in cartridges — not VIC 20 compatible — and cassettes, and uses some of the VIC 20 peripherals — like joysticks, paddles and light pens. It does not have any expansion parts, and is not planned to take any communication, disc or printer peripherals.

It has a polyphonic sound generator, and an overlay keyboard turns it into an electronic organ similar to Casio's early VL-Tones.

Commodore have signed an agreement with Bally to transfer some of their arcade games to VIC 20 and Ulitmax cartridges. Ultimax has a resolution at least twice that of the VIC 20, with a 40 column by 25 row character screen.

The VIC 20 has some exciting new programs, including VIC Avenger, a copy of the original arcade game, Slots — which is a very realistic slot machine, Poker, Jupiter Lander, Super Alien, Midnight Drive and Magic Mouse.

An 8K memory expander and a cheap modem ($109) have also been released for the VIC 20. It now has a big brother, the VIC 20 16 which has a 16K memory as standard. Also introduced is the Commodore 64, a 64K colour computer that looks just like the VIC 20, has a 40 column screen, runs all VIC peripherals and all Ultimax cartridges. This is priced at $595 — say £395 when it eventually reaches the home market.

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COMPUTER
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TEXAS INSTRUMENTS
tree
Touch & Tell
Electronic Learning Aid For Preschoolers
Press "On"
off
on

ALL AT YOUR FINGERTIPS

The Texas Touch and Tell is a game based on the original Speak and Spell. This one is aimed at younger children, and instead of a keyboard, a series of overlays present pictures, letters, numbers and shapes.

The machine then asks the player to touch the appropriate drawing and responds accordingly. With the success of the Speak and Spell, and its other systems like the Little Professor, Texas Instruments is going all out for the educational game market.

A new cheaper Speak and Spell — the Compact — has just been introduced and costs only $45.

Texas Instruments have also introduced 26 new software packages for the 99/4 computer. These include: T.I. Invaders; Car Wars; Adventure; Munch Man; Speak and Spell and Speak and Math; lots of educational software; and business aids.

TIGER'S NEW GAME PLAN

One company that made its debut in 1981 was Tiger Electronic Toys. Their systems are just available in the UK.

They have introduced some hand held games which include a built-in clock. The models have animated figures and the L.C.D. displays use multi-coloured graphics. They also have sound effects.

Caveman involves getting a little caveman past a ravenous dinosaur which is between you and the cave. Just to make life interesting you also have to dodge random lightning bolts.

King Kong involves saving a lady held captive by a giant gorilla on top of the Empire State Building. In Space Flight you defend your space fleet from the invaders.

Monster Maze has joystick control and full colour animation and involves avoiding a monster whilst getting to the centre. Finally, Dragon involves saving maidens from a tower while at the same time avoiding a fire breathing dragon.

Tiger also have a couple of educational games based around their K-Z-8 talking learning computer. These cartridges now consist of subjects such as geography and grammar. They have also introduced a talking picture book which looks very similar to the Texas Instruments Teach and Tell.

NOW WATCH THIS SPACE

General Consumer Electronics have looked around for some novel games to bring to the market. They have succeeded with a new range of wrist watch size games.

Arcade Time has Hyperblast, Planet Raiders, Galaxy Gunner and Cosmic Clash; Game Time has Firing Squad, Missile Strike, Alien Assault and Blast Away; whilst Sports Time has Football, Basketball and Soccer. They also tell the time!

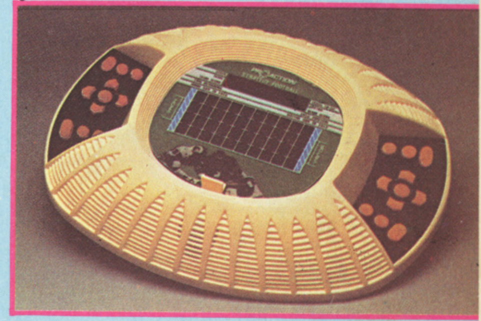
The animated LED displays occupy an area of just 1" x 1".

Casio introduced a whole range of calculators that sing, tell fortunes, play games, tell the time . . . and even calculate! They included a calculator that sounds like ten different instruments; a calculator that is really a miniature player piano that can store up to 240 notes and then play them back automatically; one that has three different games, and one that simulates a boxing ring.

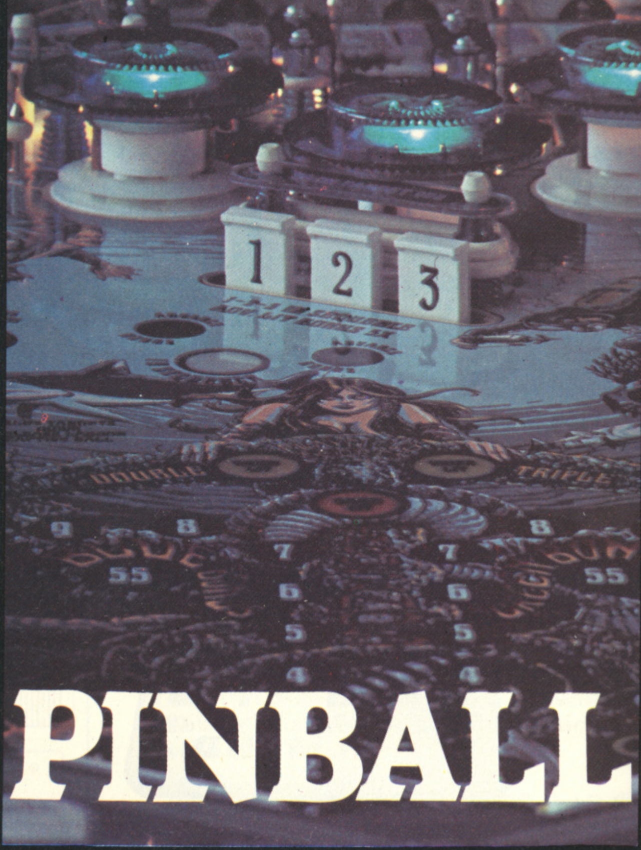
The MG777 has three built in games in addition to the usual calculating facilities. The games include Digicube, Digislot and Trackdown. Digicube is quite difficult, and involves getting all nine squares filled up with a preset number, in a preset number of moves.

Each press of a key adds one to the randomly arranged sequence. Digislot is a slot machine game and Trackdown involves following lighted squares on the keyboard. Model BG8 has a built in boxing ring when the game is activated two boxers appear in the display area of the unit.

It is up to the user to knock out the contender by pressing various keys on the calculator. As both fighters exchange punches, the unit automatically keeps score.



Pictured is the U.S. Games Corp's tabletop arcade game Super Football. This game is based on American football.



PINBALL

PINBALL IS BACK IN STYLE

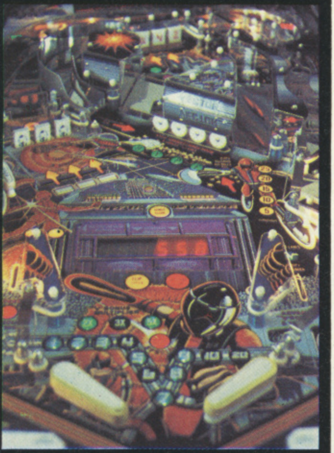
See me, feel me, touch me, hear me! . . . demand the loud, flashy machines which have quietly found their way back to their traditional haunts in pubs and arcades. Pinball is back — brighter and brasher than ever.

The video boom almost wiped out this denizen of the amusement palaces — but behind the scenes the pinball makers were working out a way to beat Space Invaders and video machines at their own games.

Aided by the microprocessor, a new generation of "pins" were born. And now you'll believe that pinball can talk! They challenge, encourage and even insult the player using a wide vocabulary of electronic utterances.

Between the Xenon machines' sensuous tones that invite you to, "Try me again", to the Medusa's fierce "Challenge the Medusa!" there are a variety of words and phrases the dedicated pinball player can wring from his favourite machine.

But how did pinball bounce back? Computer and Video Games visited the Wembley headquarters of Bally Continental — one of the big three pinball manufacturers and distributors. There we talked to David Adams, managing director of Bally's operation in this country.



Pictures by Linda Freeman

"The video boom gave pinball a shot in the arm," Adams told us. "It encouraged the evolution of the machines.

"I've been in the business 20 years and it's incredible the way they have developed. The new games are tremendous — quality-wise and player-wise.

"Three years back, arcade managers were taking out their pinball machines and replacing them with video games. Now there's a shift back to pinball.

One of the first machines Bally produced in their fight against the video games was cheekily called Space Invader — and it produced sounds just like the video game of the same name.

"Kids get to a certain level on a video machine. Say they score 10,000 points every time on their favourite machine, and they keep on scoring 10,000 points. They get so good that they become bored with it.

"With pinball, no two games are the same. They could score 10,000 one game and an embarrassingly low score the next time they play. They keep coming back to play again to beat the machine."

He adds that pinball designers now concentrate on building more features into machines to test the skills of the players.

Features like captive balls only released when targets are hit in the correct sequence, multi-level playfields and skill shots which send the players' scores soaring.

There are machines which send several balls rocketing down the playfield at the player during a game — just to keep him on his toes.

With the voice, revamped sounds and lights and the skill features these new pinball machines are in good shape to give the video games tough competition in the arcades, claims Adams.

"Pinball is always going to have knocks. It's seen it all before. There's always going to be pinball."

TARGETS TO TEST YOUR SKILL

The new neon-bright pinball machines have plenty of surprises in store for the uninitiated who step up to sample their delights.

Experienced players like to see ingenuity used in the design of the machines. Multiball features are a big favourite — but tests of skill, in whatever form they appear on the playfield, are essential if a pinball is going to be a winner.

Players also like to get clear instructions on the machines — about target sequences or bonus features and how they can get them. On some machines you can simply bash the ball around the playfield and not know why lights are flashing or if you've collected bonus points.

Players face a real challenge if they step up to one of Bally's latest pinball creations called Centaur. This sinister looking machine — it is resplendent in horror show black and white artwork — is packed with skill features.

Unique to the machine is a feature called equitable multiball. What that means is that each player has to build up his own store of balls for multiball play, getting no advantage from the skills of a previous player.

The play centres around releasing captive balls. This is achieved by hitting a configuration of targets with O.R.B.S. lettering.

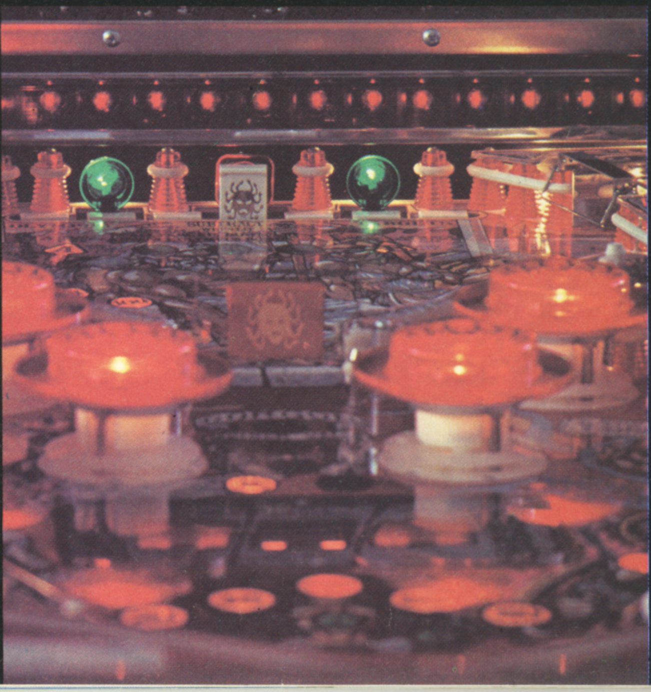
Hit in sequence these release a captive ball. Hit out of sequence they store up a number of possible captive multiballs in the machines memory — to a maximum of four.

These can be release by shooting the right passageway when it is lit.

The Centaur also has one other disconcerting feature — it plays itself. When no-one has approached its coin-slot for what it regards as an unfriendly length of time it blasts out five balls and sends them rocketing around its own playfield — just to get a bit of attention.

If this singular machine's flipper buttons are pressed when the game is over it speaks out — listing its skill features to anyone who will listen while colour coded lights flash in unison.

Elektra is another Bally machine soon to be seen in the arcades. This has a novel three level playfield — with a mini-



field at its heart. This can only be reached by collecting Elektra "time-units" on the upper levels.

It has two captive balls — on the top and second levels — which are released after targets are hit in the correct sequence. Once on the mini-field players can earn up to 195 thousand points on its bonus features.

Multiple flippers feature on Bally's Medusa game which has a two-level playfield. It also has a useful shield post located between the lower flippers which — if you've built up enough bonus points — enables you to save a doomed ball with a touch of a button. It also laughs at you when you lose a ball — which can be very irritating!

THE BIG THREE TABLE TOPPERS

The big three pinball makers are all American — Bally, Gottlieb and Williams, with a fourth, Stern taking some of the market. There is also a Spanish manufacturer — but their products are specifically for that country.

The biggest market for pinballs is — of course — in the USA. Germany and France are also pinball provinces as is Italy. In comparison, Britain is still a small market for the machine makers.

Bally — based in Chicago — has a large design team working on new themes and designs for its products.

Prototype designs are tested on site before the pinball factories swing into production of a new model. One of the new microprocessor models would cost the buyer around £1,000 — but second-hand models can be picked up for around £300. Older, electro-mechanical models can be found for less.

HOW THE PINBALL CAME OF AGE

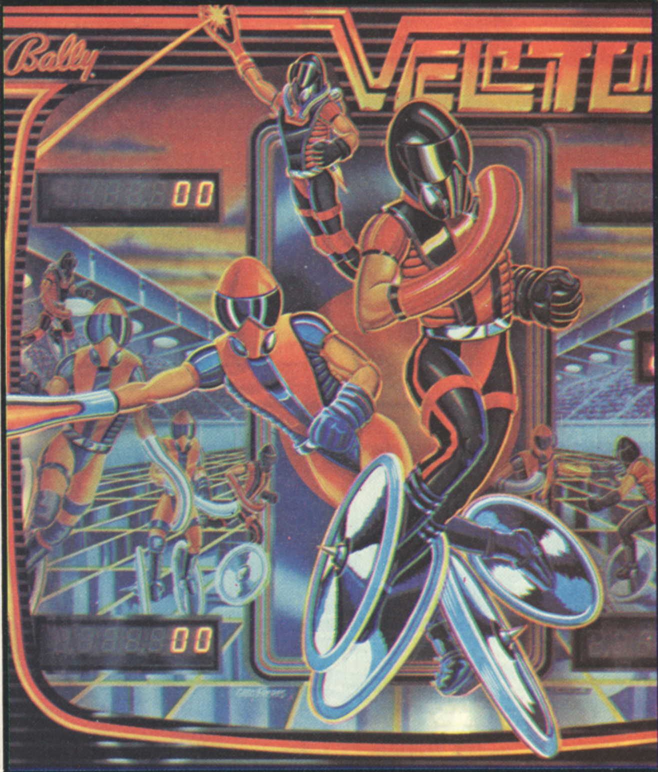
In its late 50s heyday, pinball was a really simple machine with a few pot-bumpers and a couple of flippers, completed by one-dimensional artwork on the playfield and backsplash.

Inside it was full of electro-mechanical levers and switches — a real plumber's nightmare. These machines are now collectors' items and Bally often get requests for parts and spares for vintage machines from pinball enthusiasts.

Nowadays pinballs are controlled by a microprocessor like the Motorola 6800 which masterminds absolutely everything.

One of the most successful companies, Bally, claims it will be changing this microprocessor soon in order to cut down on the number of matrix boards inside the machines.

Artwork is now a big feature of the pinball with elaborate designs decorating the backsplash — the artwork on the machine's scoreboard — and playfield.



Bally produced a machine called Lost World with an Adventure/Fantasy theme — and received orders for the backsplash alone for people to hang on their walls. Some were stolen from exhibition stands.

What will the future offer? Yet more mind-boggling playfields and tests of the players' skill. One of the newest machines, yet to be seen in arcades, is the Vector.

This has a shooter lane which fires the ball out at an angle onto the lower playfield — if you are lucky or skilful enough it whips up a chute to the top level.

PLAYING ON THE SMALL SCREEN

Microcomputers have taken pinball out of the arcade and given it a screen image.

Now that colour has become an integral part of so many home computers, the game can be brought to life in your own living room. It can still be an exhilarating game although the action bears little resemblance to the feel of a buzzing machine beneath your outstretched fingers.

Computers do have certain advantages, however and Tandy has brought out an exciting innovation for its TRS-80 Colour Computer version of the game.

This cartridge will allow the player to design his own table.

He decides how many flippers in each game, where they should be positioned and the degree of difficulty involved in the game.

In the past computerised pinball games have fallen short of the arcade machines but this now seems to be changing.

Computerised pinball is represented on the screen in several ways. As a table layout, complete with mushroom shaped bumpers with the different scores marked on them, gates which open and close at random intervals and bats which represent the pinball table's flippers.

Most of the games have sound effects which enhance play and, depending on the version of pinball, the player is given a different number of balls with which to bump up his score.

Pinball is also available on television games centres, although they are not the most popular of the range. Philips has a version for the G7000, ACE does a pinball game for the Acetronic MPU 1000, and Voltmace produces one for the Database games centre.

RASTER BLASTER DOWN TO ZERO

The T.I. 99/4a computer also has a pinball cartridge similar to the Tandy version giving a custom-designed game. This is called Zero Zap. You have to set up your own field positioning on it diamonds and crosses to increase your chances of scoring points. This game differs from the original arcade game because you have to aim an arrow which you control at a target, either diamonds or crosses, and fire. When you score a direct hit the diamonds change into crosses, and vice versa.

One of the best standard computerised pinball games is an American one on sale in the UK. It has the memorable name Raster Blaster and is available through Apple software dealers including Zynar and SBD Software of Richmond. Pat Salt of Zynar said: "It's really pretty good. Of the pinball machines I have played I think Raster Blaster is as good if not better than some in arcades."

"The flippers in arcade games haven't always worked when you want them to, or as quickly. With Raster Blaster they are very prompt and easy to control and handle."

Other computers are well-catered for on the pinball front, as well. Cassettes ranging in price from £4.50 up to top-of-the-range discs with sophisticated sounds and graphics in the £16 range, are proving popular with software buyers, as the home market follows the arcade trend.

Bally
Medusa

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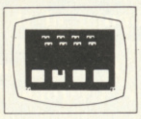
ZX80

1K Space Invaders



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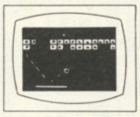
1K Breakout



An interactive graphs. 9 ball game, as Invaders written in m/c for good graphs. Try your skill and patience at knocking all bricks from the wall. Use ⇦ & ⇨ to control the paddle.

1K Music

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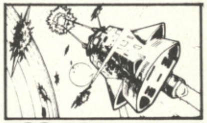

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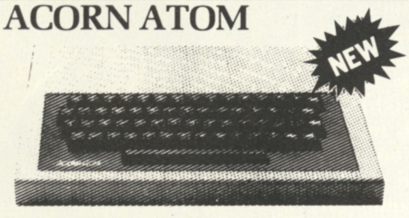

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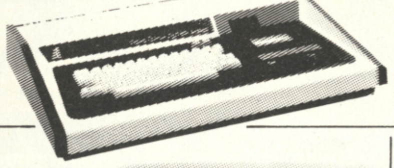

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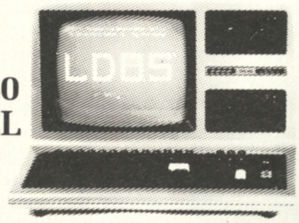

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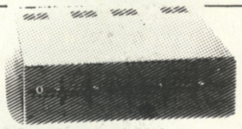

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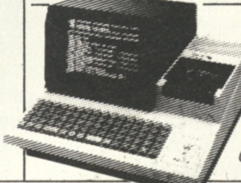

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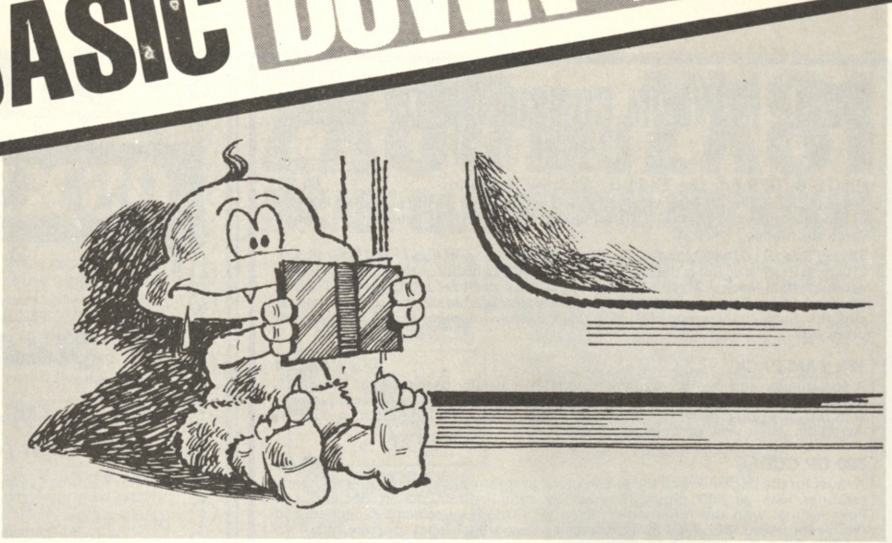
DOWN TO BASIC DOWN TO

BY MOIRA NORRIE



VARIABLE VALUES . . .

There are many occasions when it is desirable to perform a calculation in a program without immediately printing the result. It may be that the value produced is only an intermediate value in some calculation, or, the value is to be stored for use later in the program — it would be wasteful to perform the calculation more than once.

The LET statement is used to allocate a value to a variable. The general format of the LET statement is

<line no.> LET <variable> = <arith. expr.>

The operation of the LET statement can be described as follows: the arithmetic expression on the right of the "=" is evaluated; the resulting value is then assigned to the variable on the left of the "=". Assume that a program has three variables A, B and C. At some point in the execution of the program A has the value 2, B has the value 5 and C has the value 3.5. If the next statement is:

```
80 LET S = A + B + C
```

then after this statement has been executed, the value of variable S will be 10.5 and the values of A, B and C will be unchanged.

If the computer now encounters:

```
90 LET A = A + 1
```

then the following sequence of events occurs:

the computer first looks up the current value of A and finds "2", this value will be copied into the part of the computer that performs arithmetic; it then adds on "1" to get the value "3" for the arithmetic expression. On examination of the variable name on the left of the "=" it stores the value "3" for A — thus overwriting the old value of A with the new value.

The statement:

```
90 LET A = A + 1
```

therefore means, increment the value of A by 1.

Last month, I gave an example of a program to count the number of words with four letters that were typed in. In that program, I used a statement similar to the one above to increment the count each time a four-letter word is input.

Another common use of the LET statement to update the value of a variable, is the idea of maintaining a "running total" in a program. I will now look at an example of a program that uses this technique.

A football team wants a program to calculate their average crowd attendance in a season of 40 games. The outline of the program would be:

```
running total = 0
repeat 40 times
  input no. in crowd
  let running total = running
  total + no. in crowd
  end repeat
  let average = running total/40
  print results
```

In many versions of Basic, the first line is not essential since all variables are assigned the value "0" initially. When a variable is used as a count or a running total, a vital part of the logic of the program is that the variable should be initialised to "0" — it is a matter of convenience that most versions of Basic automatically perform the initialisation for us. Although the calculation of the average could be included in the Print statement, I shall put it in a separate LET statement so that the Print statement is less cumbersome.

AVOIDING MISTAKES

```
10 REM CALCULATE AVERAGE
20 REM CROWD ATTENDANCE
30 FOR I = 1 TO 40
40   INPUT N
50   LET T = T + N
60 NEXT I
70 LET A = T/40
80 PRINT "AVERAGE CROWD
ATTENDANCE =";A
90 END
```

Even this simple program could be extended. One improvement would be the use of printing messages to tell the user what the format of the data typed in should be. Examples of this were introduced last month. Another improvement would be the inclusion of data checks.

I am sure you are all well aware of how easy it is to make typing mistakes. A great problem in computing is the detection of such errors in the data. Some errors are very difficult to detect — for example, someone might type their age as "22" instead of "33" — however, others are easier to detect — for example, a person typing their age as "322" lies outside the possible range of values.

Let's assume in my previous example that the maximum crowd that the ground could hold is 20,000. Then the value of N should lie in the range 0 to 20,000. The section inside the FOR loop could be extended to

```
40 INPUT N
44  IF N<0 THEN 54
48  IF N>20000 THEN 54
50 LET T = T + N
```

```
52 GOTO 60
54 PRINT "ERROR — PLEASE
RETYPE"
56  GOTO 40
```

A further check is that N should be an integer value. This can be done using the function INT — INT(N) returns the integer part of N.

If N has an integer value, then INT(N) will equal N. I can therefore introduce one more statement in the loop:

```
42  IF N<>INT(N) THEN 54
```

For reasons of brevity, I am unable to include all these data checks in my sample programs. However, you should include them in any programs you write. Don't assume that someone running your program won't make mistakes or deliberately try to sabotage your program!

The IF statement tests whether a specified condition is true. So far, the conditions have been simple in that they only involved one test. For example:

N<0
or N<>INT(N)

COMPLEX CONDITIONS

It is possible to have more complex conditions that involve a combination of simple conditions. This is particularly useful when testing that a value lies in a specified range. In my example, I had an error condition if either N was less than 0 or N was greater than 200000. This required two IF statements — lines 44 and 48 of my program. It is possible to combine these into one IF statement:

```
45  IF N<0 OR N>20000 THEN 54
```

Thus, simple conditions can be combined using "OR" to form complex conditions. If any of the simple conditions are true, then the whole complex condition will be true and a jump will be made to the given statement.

It is also possible to check that a number of conditions are *all* true by combining them with 'AND' in a single IF statement.

```
115  IF N$ = "SMITH"  AND
A = 20 THEN 200
```

could be used to identify persons with the name SMITH and age 20.

COMMON USAGE

I have already used the functions INT and RND in the series. A number of commonly used functions are available in Basic as standard functions. This saves the programmer having to write his own programs (or parts of programs) to evaluate such functions. The standard functions provided will often depend upon the power of the version of Basic.

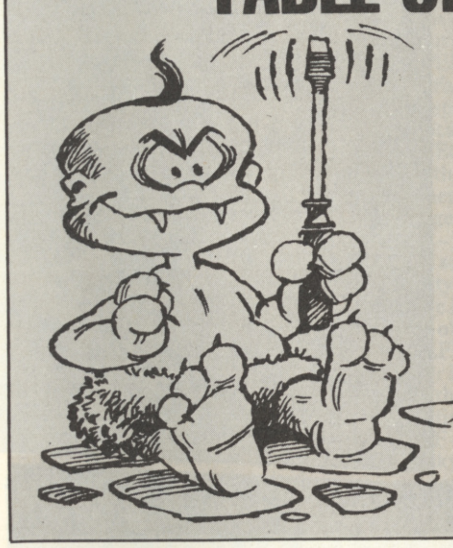
In the table, I have listed the most common standard functions and briefly described their use. As many of them are mathematical, I can only suggest that you ignore those you don't understand!

Wherever the function operates on a value — enclosed in brackets after the function name — that value may be given as a constant, a variable or an expression. For example:

INT(6 = RND+1)
LEN("CAT")

Note that brackets are not required after the function name on the Sinclair ZX81.

TABLE OF STANDARD FUNCTIONS



Function	Description	Example
INT	integer part	INT(3.2) = 3
ABS	absolute value	ABS(−) = 2
SGN	the sign of a number	SGN(−2) = −1
SQR	square root	SQR(4) = 2
LOG	natural logarithm	LOG(2) = 0.69315
EXP	exponential function	EXP(1) = 2.71828
SIN	sine (radians)	SIN(0.5) = 0.47943
COS	cosine (radians)	COS(0.5) = 0.87758
ATN	arctangent	ATN(1) = 0.78540
LEN	length of string	LEN("CAT") = 3
RND	pseudorandom number between 0 and 1	RND = 0.217873

NEXT ISSUE

SYSTEMS SUMMARY

When moving to a new computer system, or converting programs from one system to another, it is useful to have a summary of the main features of the version of Basic used.

In each future issue, I will provide a reference table for one particular system. The table will outline the main differences between standard Basic and the version used on that system. It is envisaged that most of the popular systems will be included. Next month, I will start by looking at the Sinclair ZX81.

NEXT ISSUE

Adventure

TO SCROLL OR NOT SCROLL

What is the best way to use the screen to display your adventure? Sooner or later in writing an adventure you must decide whether to use the conversational scrolling technique or a whole screen approach.

The disadvantage of scrolling becomes obvious when the player has to recall details of his location, which can soon become tiresome. As soon as the machine reply is decided it may be screened with a PRINT statement, and the program looped back to the INPUT line.

However, I prefer to clear the screen and redisplay the location details together with the machine's reply. In my opinion this gives a more polished appearance to the game, the player having more relevant information displayed at any one time.

It is also useful to display the player's last command — if the computer's reply is a bit mystifying he can check what it was responding to, a typing error maybe?

If the screen is cleared when INPUT is received, and PRINT statements executed as each piece of information to be displayed is available, the presentation will look very jerky, leaving the player in a state of nerves waiting for the whole thing to crash! This can be avoided if all the replies are assigned to variables and only when all are set is the screen cleared. All these variables can now be screened at once, providing a smooth change and giving the illusion of speed, since the screen is never really blank.

Using Q1$ for the reply, the lines 3000 to 3050 described last month will look like:

```
3030 LET Q1$ = 'IMPOSSIBLE' :
GOTO 100
```

Between lines 100 and 150 we will insert some IF statements later. Using OT$ and OW$ for the objects, display coding will now look like this:

```
100 REM start of main loop
150 LET OT$ = " " : LET OW$ =
    " " : LET OS$ = "I CAN SEE:"
160 FOR I = 0 TO 3 : IF P (I) = LN
    THEN LET OW$(I = O$(I) +
    " ."
170 IF LEN(OS$) + LEN(OW$) <
    (no of characters per line on
    the screen) THEN LET OS$ =
    OS$+OW$ ELSE IF LEN(OT$)
    + LEN(OW$) < (no. of chars)
    THEN LET OT$ = OT$ +
    OW$.
171 REM to prevent object lists
    wrapping round
180 (clear screen) :PRINT L$(LN) :
    IF LEN(OS$) > 12 THEN
    PRINT OS$ : IF LEN(OW$) >
    0 THEN PRINT OW$ : IF
    LEN(OT$) > 0 THEN PRINT
    OT$
190 PRINT "YOU TOLD ME TO";
    R1$ : IF LEN(Q1$) > 0 THEN
    PRINT Q1$ : IF LEN(Q2$/ > 0
    THEN PRINT Q2$
191 REM only print replies that
    exist
200 LET Q1$ = " " : LET Q2$ = " "
    : REM set replies to null for
    next time round
210 INPUT R1$ : REM continue
with next command
```

ENTER THE HELLFIRE DUNGEON

Many Adventures are trying to more faithfully recreate the fantasy role-playing Dungeons & Dragons game which originally spawned the computerised version.

Hellfire Warrior is an example of the D&D style — very different from the plain language type of game but just as intriguing.

The version I played was supplied on cassette for TRS-80 (Model I only), the game also being available for Pet, Video Genie and Apple machines, and on disc. The package is very impressive, and includes loading instructions for the particular machine, a command code prompt card, and a well produced and nicely illustrated booklet describing the background to the dungeons, monsters and treasures.

After loading the first program on the tape, — The Innkeeper — you are given gold coins and assigned varying degrees of the attributes intelligence, intuition, strength, constitution, dexterity and ego.

These all have a bearing on the outcome of future actions. You are now invited to bid for weaponry and armour which come in different shapes and sizes, and for slaves and elixirs.

This turns into a real bartering session, with a very realistic simulation you will need your wits about you to obtain what you need at the lowest possible price. If you offer an insultingly low price, the chances are you will get an equally insulting reply!

When fully equipped you are asked which level of the dungeon you wish to enter. Data followed by a second program — The Dungeon Master — is automatically loaded, all previous data being preserved during this load.

You are now in the dungeon, your immediate environs being displayed graphically alongside such details as: fatigue, wounds, room number. You must explore the dungeon, seeking out secret doors and traps, avoiding or killing monsters en-route whilst collecting treasures.

This is where familiarity with the command codes is useful — hang around too long and the Giant Red Ant or the Great Tick will get you!

Should you be lucky enough to get your treasures back to the inn before Olias the Dwarf catches you, they can be exchanged for gold. You can then input your latest experience level and attributes back into the Innkeeper program, and start off again towards another more difficult level.

Altogether a very deep game, and cleverly written. It should please Dungeon & Dragons fans and Adventurers alike.

Many thanks to Allgray for the review tape, and to Mark Jenkins for initiating me into D&D, before I tackled this game!

By KEITH CAMPBELL

Make the most of your Sinclair ZX Computer...

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JUNIOR EDUCATION 2
BUSINESS & HOUSEHOLD 3
GAMES 4
sinclair ZX81
ORBIT
SNIPER
METEORS
LIFE
WOLF PACK
GOLF
1K RAM

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 – including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 *and* the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.

Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status–digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

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	24	Cassette 4 – Games	£3.95	
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	18	*16K RAM pack for ZX81 and ZX80	£49.95	
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puter-

ZX 16K RAM
sinclair
ZX PRINTER
10 FOR I=1 TO 22
20 PRINT "/"
30 NEXT I
40 PRINT AT 10,0;"
50 FOR I=0 TO 63

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Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alphanumerics *and* highly sophisticated graphics.

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rsection and looked
nen came the sound
ng footsteps. I ran,
way and that but
ng above me, was
monster. The huge
to reveal his great
uld just make out
nside, I started to
have been posthum-
led 130 points and
to roam the maze
ou wish to appeal,
else press 'cont'." I
t . . . I might get out

er Maze, is the best
seen for the Sinclair

nd black walls of the
e the 3D effect and
cs make Tyran-

do manage to exit then your score is increased accordingly. It would be nice to have a high score facility included in the program, though.

The play can be speeded up or slowed down if you alter the listing slightly. Instructions on how to do this are included in the notes supplied with the cassette.

I have found myself wandering around the maze with the monster lying in wait, somewhere and not wanting to come out. It does give you a chance to find the exit, but it does take away some of the fun. This did not happen very often though. This program then can be highly recommended and is available for a 16K ZX81 from J. K. Greye Software on its games tape 4 and costs £5.95.

only remains vulnerable for a few seconds.

Not one of the most graphically exciting of games for the VIC-20 from Commodore but will keep you busy for a while. Price £19.95 from VIC software dealers.

puter-

ZX 16K RAM
sinclair
ZX PRINTER
10 FOR I=1 TO 22
20 PRINT
30 NEXT I
40 PRINT AT 10,0;"
50 FOR I=0 TO 63
60 PLOT I,22+20*SIN (I/32*PI)
9987 RETUR
9988 REM
9989 FOR
9990 FOR
9991 FOR
9992 POKE

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ZX81

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ROMAN AROUND IN ANCIENT "BRIGHTON"

CAESAR'S INVASION OF BRITAIN

England has always been a difficult country to conquer but Julius Caesar was one of the few foreign leaders to do so.

During his governorship of Gaul he invaded Britain with 600 transports carrying an army of five legions and over 1,000 cavalry. Sharpsoft of London has brought out a game which makes the player re-enact the strategy he employed to wage war against Britain.

If Sharpsoft had spelt the name of the game correctly it would have added more credence to the "Caesar's Invasion of Britain", which ultimately turned out to be worth sticking with.

"Caesar's Invasion of Brighton" (he didn't aim high to start with) is an adventure game in which your job is to capture the stronghold of Cassivellaunus, a Celtic leader, and return safely to your ships.

At the beginning of the game you are given the option of recruiting additional cohorts and cavalry and, more importantly, to hire scouts.

Scouts are vital to your operation because without them there is no way of discovering the lay of the land, and the enemy's whereabouts. That's where I made my first mistake.

You also have a money, denarii, in your purse which comes in handy for bribing potentially harmful tribes.

Food is also a vital necessity, without grain your troops will eventually starve unless you succeed in finding or stealing some bags.

While battling out the invasion in Britain you also have to deal with Roman elections, sending agents armed with money to swing power your way.

The game was repetitive when I played it. I seemed to wander around the countryside being attacked by various barbarians, losing all my denarii and finally losing the vital battle.

It costs £5.85 from Sharpsoft and runs on a 48K Sharp.

SOLAR

keyboard, and accuracy in aiming is most important.

It took me about 10 plays before I could hope to win a battle. After that I won about 70% of the time, but I have not yet conquered the whole solar system.

A MISSION TO WARP YOUR MIND

THRESHOLD

If Galaxians and Space Invaders caused you headaches,
you migraine.
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The third type of alien looks more like a member of the fish family and swims across the screen above your ship.

Your five ships are lined up on the right hand side of the screen, and when play begins the engines start to rev up.

Sheer compulsion apart, the game boasts imaginative graphics and sound effects.

Because of the proliferation of aliens, points are quite easy to score and you also get bonus ships after notching up 50,000 points, 100,000 points.

Well worth spending the £19.95 on Threshold for your Apple II (48K). Richmond based S.B.D. Software is the supplier.

operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.

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ROMAN AROUND IN ANCIENT "BRIGHTON"

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SOLAR STRATEGY

GALACTIC ATTACK

This battle for control of a solar system relies on more than just reactions and a fast finger on the fire button.

The object of this dull but very addictive game is to colonize a solar system or free it from the Kzintis-depending on your point of view. It is a difficult game to master and requires strategic thinking as well as tactical manoeuvres and rapid reflexes.

Control of your ship is via the keyboard, and requires quick thinking when under attack from Kzinti ships. You also control your Torps and Phasers from the keyboard, and accuracy in aiming is most important.

It took me about 10 plays before I could hope to win a battle. After that I won about 70% of the time, but I have not yet conquered the whole solar system.

The display is nice, showing each planet in a distinctive way, and the scale has been well chosen to allow you to get lost, but not too often. Another nice feature is the ability to specify various parameters such as number of Kzinti ships in each attack, speed and effectiveness of Torps, and other vital items.

Beaming armies up and down between ship and planet is an added complication which I enjoyed but it is tedious in the early stages.

Recommended to all committed space war enthusiasts with time to spare!

Galactic Attack runs on a 48K Apple under DOS 3.3 or Pascal, costs £17.55 and is available from Woodland Software.

A MISSION TO WARP YOUR MIND

THRESHOLD

If Galaxians and Space Invaders caused you headaches, Threshold will give you migraine.

It is one of the most compulsive games I have come across since green meanies and winged creatures first flew onto my screen.

Each time you successfully destroy one wave of invaders, a different breed of creature attacks.

You get five ships fully equipped with Delta class lasers to blast the aliens, but you must take care not to run out of fuel by firing too many missiles.

Also at your disposal is a hyper warp drive which slows down the alien action for a few seconds. But because of the power consumed during its use you can only activate it once.

The first onslaught of aliens are bat like creatures. These are followed by Galaxian types which plummet in a kamikaze style dive towards your ship.

The third type of alien looks more like a member of the fish family and swims across the screen above your ship.

Your five ships are lined up on the right hand side of the screen, and when play begins the engines start to rev up.

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TAKE A SPIN DOWN THE ALLEY

TENPIN

Tenpin bowling must be one of the last sports which would seem suitable for computerisation.

It says a lot for computer games designers that they have come up with a version which recreates the need for a good eye and judgement, and still manages to be entertaining.

The screen shows the tenpin lane from the viewpoint of the bowler, with the machinery, and the 10 pins that are to be knocked over in the distance.

The rules of tenpin bowling are simple, but for those not familiar with them, adequate instructions are included with the program.

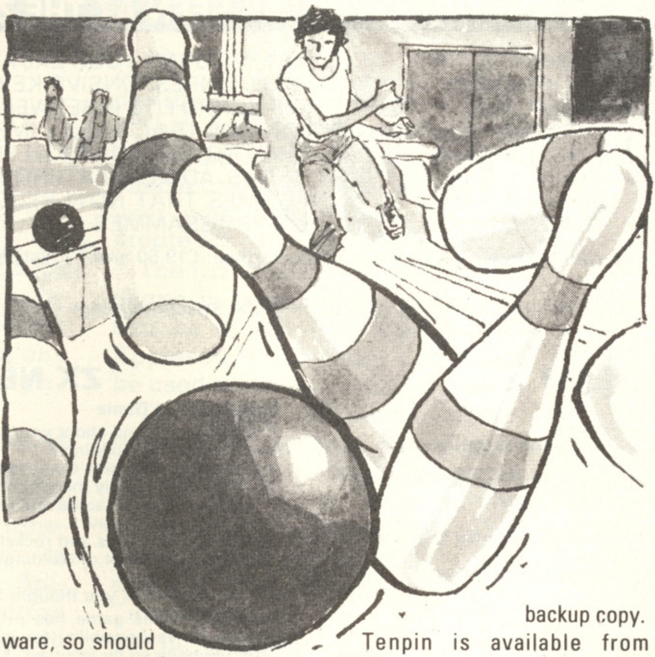
A ball is rolled down an alley with the aid of the computer's two arrow keys and the space bar. Markings, a third of the way down the alley, assist in aiming the ball, and a spin can be given to the ball any time up to it reaching these markings. A game consists of 10 frames per person, you are allowed up to two balls per frame to knock down the 10 pins. The computer keeps your score, and displays this, together with any "strikes" or "spares" (knocking over all 10 pins with one or two balls respectively) at the end of the lane, to the left of the pins. To the right of the pins is shown a plan view of the pins remaining standing.

At the end of the game the scores for each player is shown and you have the option of taking part in another game.

There can be between 1 and 4 players and the game has the added effect of sound available through an amplifier.

As usual the Tandy graphics are a limiting factor with this simulation, though not as seriously in this game as in others, and should not spoil the enjoyment. A more serious problem is the fact that the ordinary user would find it difficult to take a backup copy of the program.

Distributor Molimerx is to be praised in supporting his software, so should a copy be spoiled, a new one would be provided, but it would have been nice to have the facility (such as there is on the original adventure game) to make one backup copy.



Tenpin is available from Molimerx for the Tandy TRS-80, Models I and III and Video Genie, models I and II. The tape version costs £10.93 and the disc version, £14.95.

AMAZING JOURNEY THROUGH PREHISTORY

3D MONSTER MAZE

Wandering around the fairground sideshows, I heard a busker enticing the crowd to roll-up and see the prehistoric monster.

I paid up and entered the tent, only to be enveloped in a grey mist which transported me back into the era of that mightiest of beasts, Tyrannosaurus Rex.

Exploring tentatively, I stopped at an intersection and looked around me. Then came the sound of approaching footsteps. I ran, turning this way and that but there, looming above me, was the dreaded monster. The huge jaws opened to reveal his great teeth. I could just make out something inside, I started to read: "You have been posthumously awarded 130 points and sentenced to roam the maze forever. If you wish to appeal, press 'stop' else press 'cont'." I pressed cont . . . I might get out this time.

3D Monster Maze, is the best game I have seen for the Sinclair ZX81.

The grey and black walls of the maze provide the 3D effect and the graphics make Tyrannosaurus Rex look suitably frightening as it paces toward you. The maze corridors are constantly changing as you press the 5, 7 or 8 keys to walk forward or turn the corners. There is a way out of the maze but I have only managed to find it twice. If you do manage to exit then your score is increased accordingly. It would be nice to have a high score facility included in the program, though.

The play can be speeded up or slowed down if you alter the listing slightly. Instructions on how to do this are included in the notes supplied with the cassette.

I have found myself wandering around the maze with the monster lying in wait, somewhere and not wanting to come out. It does give you a chance to find the exit, but it does take away some of the fun. This did not happen very often though. This program then can be highly recommended and is available for a 16K ZX81 from J. K. Greye Software on its games tape 4 and costs £5.95.

SPADE AND SHOVEL WORK

ALIEN

A monster infested maze is the playground for a defensive deathgame.

The only way to survive in Alien is to dig holes at strategic spots in the labyrinth. When one of the killer red aliens falls into your trap, you can finish him off by quickly filling it in.

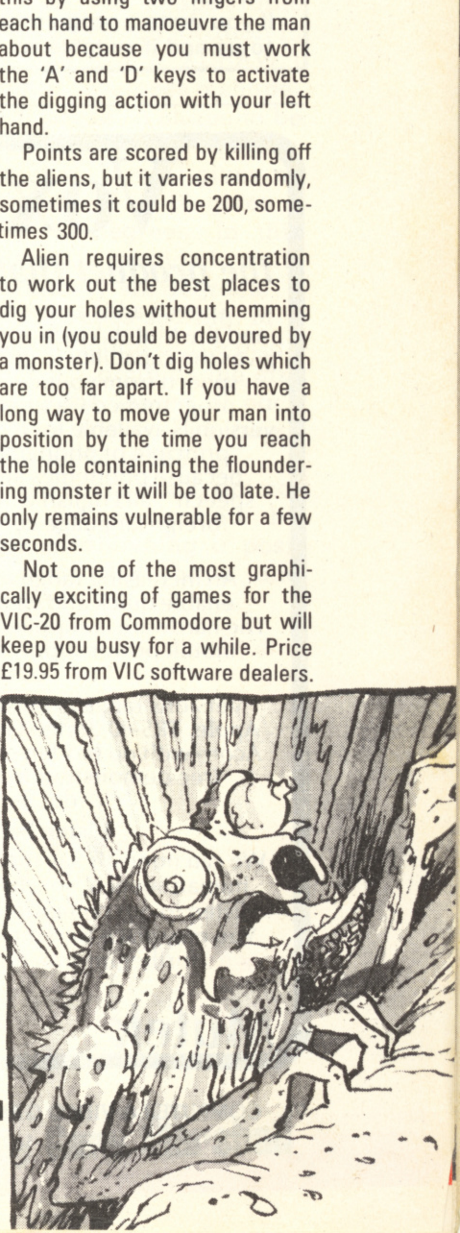
Using the keyboard controls this game is awkward to play — joysticks are better. The keys to operate your man are bunched together and to move him up, down, left or right needs some getting used to.

It's impossible to get around this by using two fingers from each hand to manoeuvre the man about because you must work the 'A' and 'D' keys to activate the digging action with your left hand.

Points are scored by killing off the aliens, but it varies randomly, sometimes it could be 200, sometimes 300.

Alien requires concentration to work out the best places to dig your holes without hemming you in (you could be devoured by a monster). Don't dig holes which are too far apart. If you have a long way to move your man into position by the time you reach the hole containing the floundering monster it will be too late. He only remains vulnerable for a few seconds.

Not one of the most graphically exciting of games for the VIC-20 from Commodore but will keep you busy for a while. Price £19.95 from VIC software dealers.



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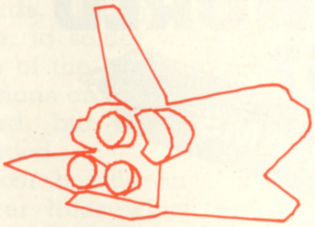
IMAGES ON AN APPLE

The high-resolution graphics facilities of the Apple can be used to create and manipulate shapes. This can be done on any microcomputer with high-resolution graphics.

However, on the Apple, shapes can be represented and stored in a special way so that they may be drawn, erased and transformed more quickly than is possible with other micros. Animation using high-resolution images can be achieved much more realistically and impressively on the Apple than on any other machine.

The way in which images have to be stored when using the Apple appears rather awkward at first, but in fact it is no more difficult than any other way of representing and storing an image and is soon mastered.

Fig. 3



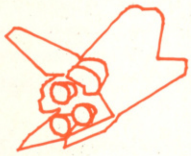
If you want to achieve realistic animation, the effects that the Apple can give are amazing. No system which relies on Basic alone, possessing no comparable special features, gives anywhere near the same speed of execution.

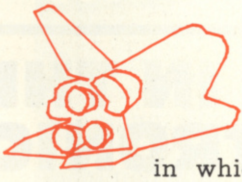
Of course, if you are more interested in *creating* graphics than in looking at them, you may feel that the Apple makes it too easy by doing all the interesting work, but then you don't have to use the special features.

The facilities needed by a programmer to create graphic effects are all available, and the user who wants to do so can create his own graphics system.*

The first diagram shows how a shape is represented, so that it can be stored and the special Applesoft commands can then be used to draw and transform it.

The simple bat shape shown in (a) is decomposed into simple vectors which all have the same length but which point north, south, east or west, as in (b). The vectors making up the shape are then "unwrapped" as in (c) and are then coded. The coding table is given in (d), and the order in which the vectors are coded and written down is shown in (e). The coded form of the shape is to be stored in eight-bit memory locations. Since the code for each vector has three binary digits, two codes can be stored in each location while the remaining pair of binary digits in each location are both zeros as shown in (e). The resulting table of binary digits is given as (f).





In (g) this table has been translated to hexadecimal and given a header and an end marker, and this is the shape table which represents the bat shape.

The shape table can be loaded into any convenient part of the memory where it will not be over-written, and the address at which it starts should be placed in the locations with hexadecimal addresses E8 and E9.

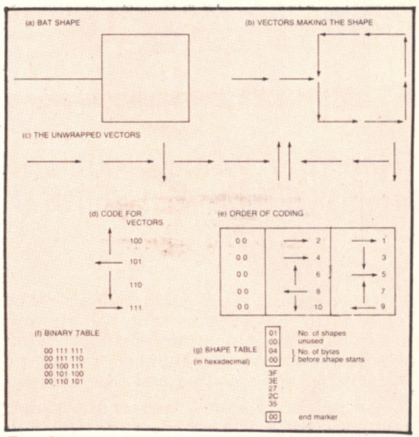


Fig. 1

When a shape is stored in this way, the following commands can be used.

DRAW 1 AT X, Y draws shape number 1 in the shape table starting at the screen location in column X and row Y. XDRAW 1 AT X, Y similarly erases a shape.

ROT = N causes a shape to be rotated clockwise according to the value of N. N = O gives no rotation, while N = 16 gives a rotation of 90 degrees. In this way, N gives the rotation in units of approximately six degrees.

SCALE = M causes scaling. M = 1 gives reproduction at the original size; M = 2 doubles the size by doubling the length of each vector in the shape. The maximum value for M is 255.

With these commands, animation can be achieved by repeatedly establishing a position, drawing the shape and then erasing it.

Figure two was produced by the program:

```
10 HGR : HCOLOR = 3
20 FOR I = 1 TO 3
30 X = 50*I : Y = 100
40 DRAW 1 AT X, Y
50 NEXT I
```

Figure 3 resulted from:

```
10 HGR : HCOLOR = 3
20 ROT = 0 : SCALE = 24
30 FOR I = 1 TO 3
40 X = 50*I : Y = 70 - 15*I
50 DRAW 1 AT X, Y
60 ROT = 64-3*I : SCALE =
24-4*I
70 NEXT I
```

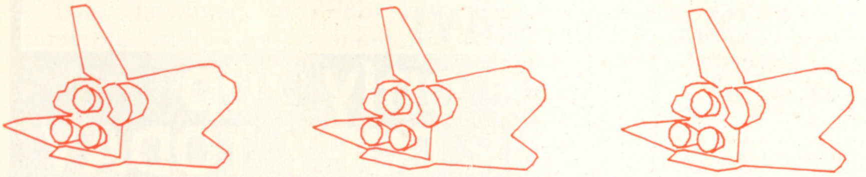


Fig. 2

By Gary Marshall

SOS Missile Command...Multihead Destructors destroyed city...SOS Missile Command... Cluster Mines sighted... ...SOS Missile Command...Plasma Projectile assault...SOS Missile Command...Satellite Bombs in range...SOS Missile Command...Megon Annihilator destroyed further city...SOS

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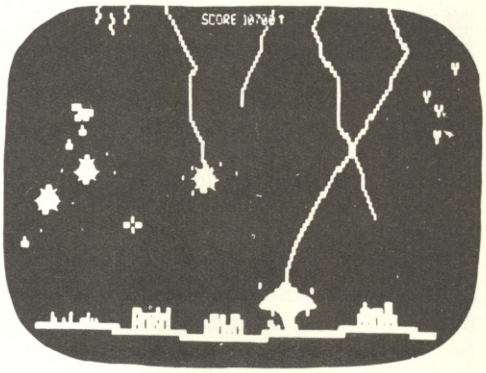

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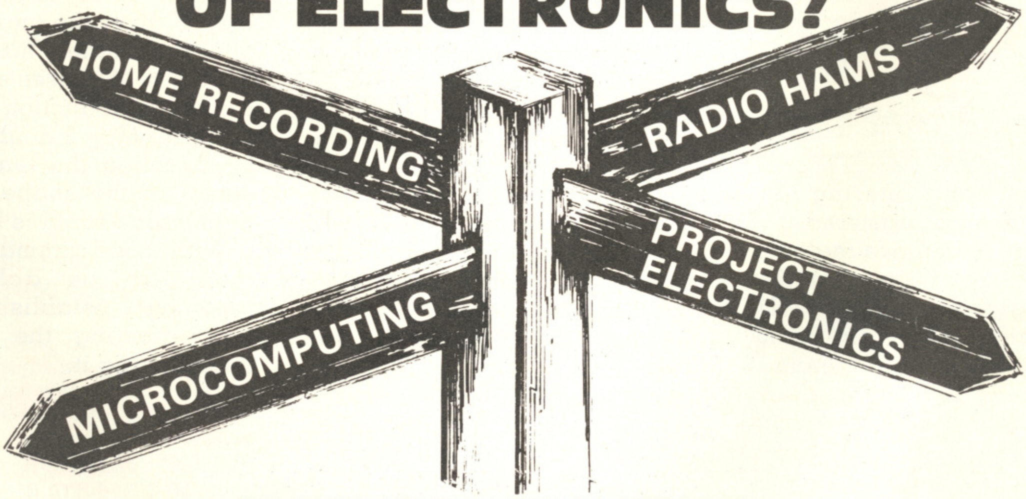

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The eurocard is a versatile aid to those of you building your own circuits. Unlike other types of matrix board it has been designed especially for the use of chips — but it can also be used for discrete components.

The eurocard comes in various sizes and designs depending on the supplier and the use to which it is to be put. Some types allow for an edge connector and others for rack mounting. The most commonly used by hobbyists just has a double row of holes at each end of the board to allow pins to be inserted and wired to.

The tracks, which run on both sides of the board, are designed to accept chip holders of any standard size. You should be prepared, however, to buy special wire-wrap holders if you are using chips with more than 20 pins, as these will take up all of the solder pads on some of the boards. It is possible, in this case, to solder wires on to the pins of the holder to make connections on the underside of the board, but this is not recommended.

Most boards have a pair of power lines which are placed conveniently across the top and bottom of the card where the chips are designed to go. By a single short link to the chip the necessity of individual wiring is done away with. Be certain though to make these connections to each chip first as it is possible to mistake later wiring for these.

If I am using one of the eurocards for a prototype circuit I lay it out in an orderly manner with chips evenly spaced across the board making it easy to see where I have already wired connections.

This, however, may not be possible with, say, a memory board which is required to fit into a very restricted space but may, nonetheless, have a large number of chips of various sizes.

For a low density card the method of wiring can either be by soldering single- or multi-stranded, insulated conductor or by wire-wrapping using the special cable.

In the case of high density boards the most satisfactory means of making connections is to wire-wrap, and sometimes it is the only practicable method. The idea behind this process is that with extended pins on the chip holders the wire can be wound around, either manually or by the use of a hand tool, to make the connections.

It means that the holders, which previously had to be spaced, can now be placed almost on top of each other, thus making the size of card required for the design much smaller, saving space and money.

WRAPPING THINGS UP

There are, as I said, two slightly different methods of wire-wrapping. The first, and easier, is to take a very light gauge insulated wire, strip it and wind it around the base of the pin. Do not wind over the top of a previous solder as you may need to unwrap it if you have gone wrong. Even so you should wind the wire around a minimum of three times, so that if there are more than two connections to be made on the same pin there is enough space left.

There is a tool specifically designed for this purpose, looking very much like an inverted needle. There are, however, a number of different models so try them before picking one.

Using the wire-wrap tool makes light work of an often difficult job. The battery operated tool cuts the job time in half — if you know how to use it correctly.

The idea is to wrap an insulated wire around the pin at a very high speed but low torque. The square edges of the pin cut through the insulation and a cold forged weld is formed. This is a great improvement on the soldered contact although the number of times you can remove the join to remake it is limited.

As with the other methods, the first connections made should be the power lines. You can then be sure that it is a chip that has gone down and not just lack of power.

It is a good idea to loom the power lines, as it is with data or address lines. That is to say, a single is taken from the power point on the card to the first pin, terminated, and then from that pin to the next, and so on and so forth across the board. Beware of over-loading the conductor if you are using too many chips, or high-powered ones.

Designing your own circuits, building them and getting them to work can be very rewarding, but unless you have an idea of how to go about it you can be stumped very easily. By choosing the right method you can cut out a large amount of the hassle involved. Experience will tell you which way is best.

BY KEITH MOTT

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Four thieves broke into a bank and stole a number of bags of coins.

They decided to lay low for a while and hide in a wood. In the middle of the night one greedy thief woke up and decided to take his share of the loot.

He divided the bags into four equal piles and found he had one bag left over. So he took this spare bag and one of the piles and hid them away for himself.

Each thief in turn awoke and decided to take his share — not knowing some had already been taken — and each in turn found one spare bag, which they also kept, when dividing into four equal piles.

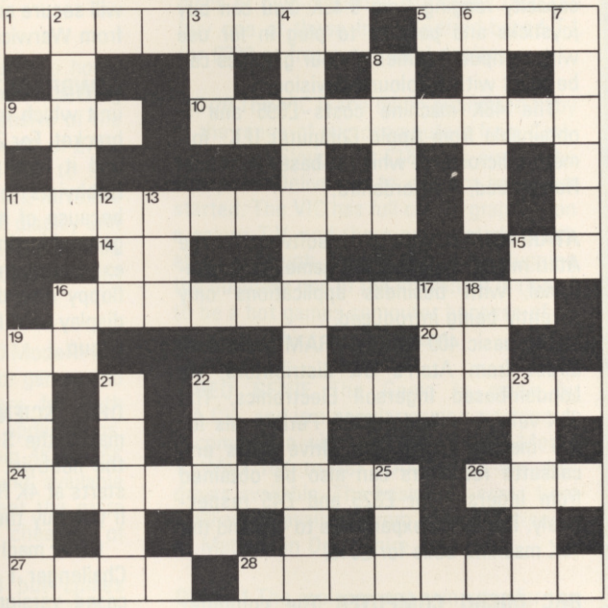
In the morning they all awoke and divided the loot into four equal piles. This time it went exactly. Nobody commented on the diminished piles because they were all guilty.

They all then went their separate ways picking up their hidden loot on the way. When the last man to awake in the night counted his loot he found he had a multiple of 10 bags.

What was the smallest number of bags they could have stolen?

David Simmons, of Colborne Way, Worcester Park, Surrey and Mrs M. Dickson from Grove Avenue, South Kirkby are this month's champagne winners. Answers to March problems on page 9.

NEVERA CROSSWORD



ACROSS

1. Concerning advertisement just can't be edited (4, 4)
5. Nudge in the RAM (4)
9. In which 0 — 9 A — F says it all (3)
10. Asking about quinine R.G. Compound (9)
11. Star games (9)
14. Headless feline print appendage (2)
15. Energetic pursuit of tail-less micro (2)
16. Programmed literature? (1, 5, 5)
19. White power leaders in office computer equipment (2)
20. Personal assertion in middle of time (2)
22. Stray labs confused laser output (3, 5)
24. Devoted as a slave peripheral (9)
26. Computers kit containing slalom equipment (3)
27. Bridge player in a stew (4)
28. Treasonable output (8)

DOWN

2. Odds or their opposite (5)
3. SIN (X) $*$ SIN(X) + COS (X) $**2$ (3)
4. £51 on the palace display (6, 7)
6. Charge on logical alternative constellation (5)
7. Northern genie mixed up the driving force (6)
8. Noisy plugs (4)
12. Bat round print position (3)
13. Ate up the anticipated advent (3)
15. Programming language on the back of the disk (2)
16. Allied Press paper contents (2)
17. Way amongst the deviations (3)
18. Print measures in the dodgem slots (3)
19. Restricted graphical view of a bawl on a squall (6)
21. Civil servant surrounds poetry such as ASCII and EBCIDC (5)
22. Have a care about a Grand Prix (4)
23. To know the reward from a fruit machine (5)
25. Pixel lady (3)

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HARD

A GUIDE TO THE LOW-COST COMPUTERS

ATOM Cambridge based Acorn Computers manufactures the Atom machine which has a memory capacity of 2K, but it can be upgraded to 12K.

It must be plugged into a television and is available in either kit form or ready built. As a kit it costs £120 for the 2K computer or £150 for the finished product. For a more powerful system, 12K, the price stands at £220 (in kit) and £250 completed.

Acorn also makes the Systems 1, 2 and 3 which cost between £69 and £750.

APPLE The Apple has a solid software base for both business and entertainment applications. The machine comes with a memory capacity ranging from 8-48K. You can buy joysticks and paddles to plug in for use with computer games. Colour graphics can be used with a colour television.

The 48K machine costs £695 and is obtainable from Apple Computer U.K., formerly Microsense which is based in Hemel Hempstead, Hertfordshire.

ATARI 400/800 Most of the software for the Atari microcomputers are games or educational, with business applications only recently being introduced.

The basic 400 with 16K RAM costs £340 direct from Atari's UK distributors, via London-based Ingersoll Electronics. The 32K version sells for £395. Peripherals for the machines, like disc drive units and cassette recorders can also be obtained from Ingersoll for £325 and £45 respectively. The 800 is expandable to 48K and the 16K machine sells for £645.

BBC MICRO COMPUTER The computer adopted by the BBC to sell in conjunction with its forthcoming series is based on the Acorn Proton. The BBC has developed its own Basic to be used on the machine. Minimum memory is 16K RAM, maximum being 32K. Present plans for the machine are dual purpose, both business and games. Optional extras include joysticks, paddles, disc drives and a cassette for tape loading.

Price is put at £235 for the 16K computer and £335 for the 32K version.

DAI This is a personal computer made by Data Applications for both business use and home entertainment. The U.K. system (it is made in Belgium) has 48K RAM as well as full colour and sound commands. Data Applications is based in Cirencester, Gloucestershire. The 48K system now costs £595.

MICTROTAN 65 Tangerine Computer Systems produce this machine for games and personal use, like household accounts. It comes in kit form and is expandable from an initial 1K memory up to 48K RAM. The Microtan 65 costs £79.35 for the 1K kit, or £90.85 assembled from the Ely based firm.

NASCOM There are two Nascoms available at the moment, both can be used for business and games. The Nascom 2 is the more powerful of the two with 8K RAM and with a Basic interpreter.

It can be bought in kit form and off the shelf complete. The kit is £125 for 1K RAM and £140 for the finished 1K product. £225 will secure an 8K kit. Nascoms are available from Warwick-based Lucas Logic.

NEWBRAIN This is a hand-held computer unit which is at the low end of the price bracket. For 2K RAM you pay £159 upwards and it is expandable to 20K of memory. Hobbyists often opt for this machine because of its low cost and it is used for general business and for playing games. An expansion unit is available which supports floppy disc drives, a printer and a visual display unit. It is available from the Grundy Group.

OHIO SCIENTIFIC Ohio Scientific (OSI) makes the Superboard which is aimed at the hobbyist market. Its memory capacity starts at 4K RAM and is expandable to 32K if you buy the add-on board.

Other machines in this family include the Challenger 1 and 4. These are essentially, cased versions of Superboard. The Challenger 4 is the cheapest of these at £575 and includes colour and sound options.

PET Made by Commodore Business Machines, the Pet ranges from 8K RAM to 32K RAM. It is used mostly by small businesses for general applications but has a hefty hobbyist following. It is available from Commodore of Slough at a starting price of £460. Compatible peripherals are available for the Pet, including disc drives, cassettes for loading tapes and printers.

SHARP MZ-80K Popular with both business and home users, the Sharp's memory capacity starts at 16K and has a top limit of 48K. It comes with a monitor and a cassette recorder built onto the keyboard unit. Disk drives are also available. Manchester-based Sharp Electronics have a recommended retail price of £460 for the 48K unit.

CORE

S AVAILABLE IN THE UK

SHARP PC-1211 The smallest computer in the Sharp range. Sharp classifies it as a pocket computer and it is programmable in Basic. It also has a cassette interface for loading and costs upwards of £85.

SINCLAIR There are two types of Sinclair's microcomputer available for under £100. Sinclair really brought the microcomputer into the home. The machines are ideal for learning the rudiments of computing but are limiting graphically. The ZX80 has 1K of memory and is expandable up to 8K, but is no longer in production. The ZX81 sells for £49.95 for 1K in kit form or £69.95 ready assembled. The 16K RAM packs costs £49.95.

SORCERER The Exidy Sorcerer is a home computer with a sizeable games following but it is one of the more expensive of the microcomputers, costing upwards of £749. Memory amount ranges from 48K to 55K and there is a plug-in ROM pack for extra capacity. Disc drives and visual display unit are an additional cost. Sorcerers can be obtained from a Cornish firm, Liveport of St Ives.

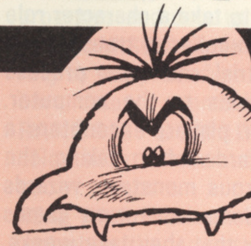
TANDY TRS-80 Tandy's TRS-80 Model 1 is a machine which is often used for games and is well-supplied with software for both entertainment and business applications. Its memory capacity goes from 4K to 16K but there is an expansion unit available upgrading it to 48K if you want the extra memory. The Model 1 is the cheapest of the Tandy range.

The Model 1 costs £459 but comes complete with a monitor to use as a V.D.U. and a cassette. The Model III is an integral unit made up of a keyboard, 12" screen and two slots for 5¼" discs. It costs from £499.

TANDY TRS-80 COLOUR COMPUTER Tandy's latest addition to its range of computers is the Extended Basic Micro Colour Computer (or TRS-80 Colour Computer for short). It is available with either 16 or 32K of memory and costs £449.

The actual computer unit consists of a keyboard which can be plugged into any television set. It is aimed at both business and games users and Tandy has bought out a variety of instant loading games program packages for the machine.

Joysticks needed to play some of the games are extra and cost £17.95 a pair. The colour computer can be obtained from Tandy stores nationwide.



TI-99/4A This computer has recently been re-launched by Texas Instruments. It consists of a separate keyboard with graphics facilities in full colour and now plugs in to a U.K. television. Software available for it from Texas Instruments is mostly business and educational but the firm has recently introduced a bundle of games to run on the computer. It has 16K RAM and uses tapes, discs or plug-in games cartridges. You can buy one of these from Bedford-based T.I. for £299 or from your local dealers.

VIC-20 The VIC is the much-publicised baby of the range of microcomputers from Commodore of Slough. At £185 it is one of the cheapest. Deliveries to dealers have just started. The VIC has full colour graphics on a colour T.V. and there are joysticks available. Although Commodore are plugging the business use of the machine it is tipped to be a hot games computer because of its colour graphics and low cost.

VIDEO GENIE The Genie is made by E.A.C.A. and is a popular games machine. It is compatible with the Tandy TRS-80 Model 1. With 16K to 48K RAM there are disc drives available. The basic unit costs from £369 and is available from Lowe Electronics of Matlock in Derbyshire.

GENIE 1 The replacement computer for the Video Genie is now available. The Genie 1 is an upgraded version of the Video Genie and has full upper and lower case, a machine language monitor, additional Basic, has a sound unit and is cassette based. It is being aimed at the serious hobbyist market and costs £229. A disc version is available, called the Genie II and sells for £310 for the unit, £199 for the expansion box needed, and £225 for each disc drive.

U.K.101 This machine comes in either kit form or ready built with memory capacity of 4K to 40K (with an expansion board). It contains television and cassette interfaces so you don't need a V.D.U. The U.K.101 is a popular computer for playing games and there is a lot of software around for it. The kit costs £149 for 4K, ready built it sells for £199.

SUPERMARKET

ZX-81

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SOFTWARE GLOSSARY

A beginner's guide to plain jargon

ADVENTURE A type of game in which the player has to take a character role and retrieve a number of treasures or objects by a trial and error process giving instructions to the computer. The "hero" (or player) encounters a variety of hazards often taking the form of dangerous monsters, wizards and animals. Some adventure games are so complex that they take weeks, or months, to solve.

ALGORITHM A process or set of rules to carry out a task or solve a mathematical problem.

ARRAY A series of items (data or information) arranged to form a meaningful pattern.

ARROW KEYS The keys on a computer keyboard marked with arrows. Used for moving the cursor across, or up and down the V.D.U. screen.

ASSEMBLY LANGUAGE A language built up with memory codes designed to make programming easier.

BUG A slang term given to a mistake in a computer program which prevents it from working. It can also refer to a mechanical, electrical or electronic defect in a computer.

BYTE A term to measure a number of Bits (Binary digiTS), usually eight bits to a byte.

CAPACITOR An electronic component.

CHARACTER STRING A sequence of characters in a row.

CHIP A tiny piece of silicon which holds all the components that make up a microprocessor.

COMMAND In writing programs this word refers to an instruction word which specifies an operation which the computer must perform.

COMPUTER LANGUAGE Languages are used to make the computer perform operations. They consist of instructions or commands. There are different types of language for carrying out different tasks.

CONVERSATIONAL SCROLLING Data displayed on the screen involving step-by-step communication between the user and the computer.

DEDICATED CHIP A chip (microprocessor) which has been specially programmed to perform a single or special group of applications, e.g. computer games. ROMs are usually the means by which dedicated chips are developed.

DISC A magnetic storage device. It can be either a hard or floppy disc. Hard discs can usually store more information than floppy discs and are used with mainframe computers.

DISC DRIVE A unit which is connected to the computer, used for loading the information stored on discs into the computer.

DISC STORAGE The method of storing information on discs as opposed to cassettes.

EUROCARD A type of printed circuit board suited to circuits with a large number of chips.

FLOATING POINT This is a notation used for the calculation of numbers in which the arithmetic point, binary or decimal, is movable but not necessarily the same for each number.

FUNCTION A special purpose or characteristic action.

GRAPHICS The name given to pictorial representation of data.

HARDWARE The general term given to all pieces of electronic and mechanical devices which make up a computer system, i.e. the actual machines.

HIGH RESOLUTION GRAPHICS A method of using Basic commands to move a drawing head to any position on the screen and drawing a line between two specified points. This facility is available on several makes of microcomputer. These graphics can be recreated in greater detail and to a higher degree of accuracy.

INPUT Information (data) fed into a computer.

INTEGER A number which does not contain a decimal point, i.e. a whole number.

INTERACTIVE A word used to describe a system which is capable of real-time man-machine communications.

K Abbreviation for kilobyte.

KILOBYTE A measurement of memory capacity. 1024 bytes of memory. So 8K is equivalent to 8192 bytes.

LANGUAGE See "Computer Language".

L.C.D. (Liquid Crystal Display) A display containing liquid crystals which light up when electricity touches them. Used in calculators and watches.

L.E.D. (Light Emmitting Diode) Provides a simple display and consists of an electron tube which lights up when electricity is passed through it. Used

SOFTWARE GLOSSARY

A beginner's guide to plain jargon

as an alternative to liquid crystal.

LOAD Putting information from auxiliary storage into internal storage of a computer. It can be either a complete program or any data. When you load a program you put the contents of the program into the computer's memory from storage either on a disc or a cassette.

LOOP A Basic function referring to the repeated execution of a series of instructions for a fixed number of times.

MACHINE CODE The term used to refer to symbols or numbers assigned to parts of a machine.

MAINFRAME COMPUTER The jargon work used to describe a very large computer.

MEMORY A device which information — data — can be copied into, stored, and later obtained from.

MICROCOMPUTER A tiny computer (as the name suggests) consisting of hardware and software. The main processing blocks are made of semiconductor integrated circuits.

MINICOMPUTER This is a computer which offers memory ranging from 4K to 64K and are characterised by giving a higher performance than microcomputers or programmable calculators.

MONOCHROME COMPUTER DISPLAY A display screen used in a computer which shows a picture in one tone or black and white only.

NUMBER CRUNCHING The operation in computing which carries out the arithmetic and logical processes which information has to go through.

NUMERIC KEYPAD This is a section of the keyboard consisting of a small number of keys. They differ from alphanumeric keys because the numeral, decimal point, and enter keys transmit unique escape sequences.

OUTPUT Data which is emitted from a computer system, either on the screen or in printout form.

PEEK A statement used in Basic which allows you to read the contents of a specified memory address.

PERIPHERALS Equipment which is used with a computer, e.g. printers, V.D.U.s and disc drives.

POKE An instruction used in most versions of Basic allowing you to store integers in a specific place in memory.

R.A.M. (Random Access Memory) This is a memory chip which you can load programs and data to and from.

RANDOMISE A Basic command referring to the procedure for making numbers, data, or events occur at random.

RANDOM NUMBER A number selected at random from an ordered set of numbers.

REAL TIME This is on-the-spot computing when the operation is performed during the time an event is taking place in time to influence the result.

ROM (Read Only Memory) A memory chip which can only be read from and not written into.

ROUTING Is the method of calling up on screen information in Prestel. On the back of each Prestel page is information in the form of lists of numbers which the computer searches to find the number of the page the user wants to move to next.

ROUTINE A set of coded computer instructions used for a particular function in a program.

SOFTWARE Another name for computer programs. It can also refer to computer documentation.

STATEMENT an instruction in a computer program.

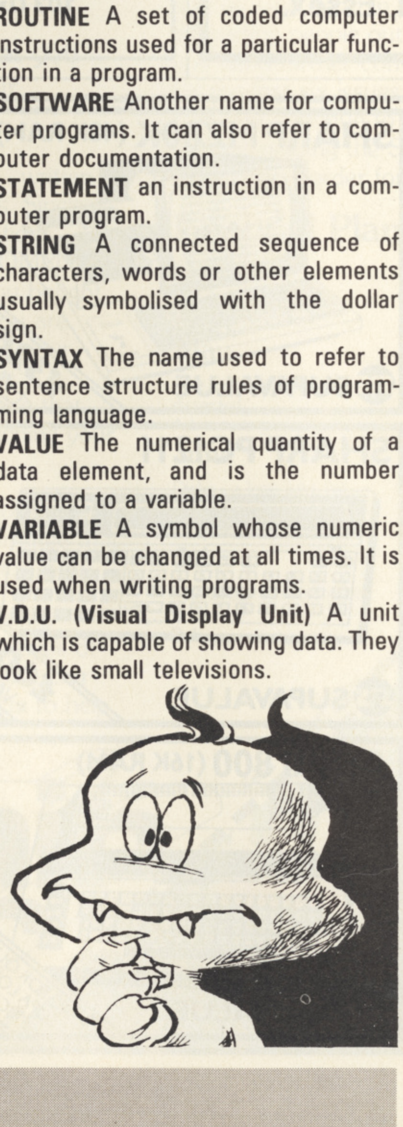
STRING A connected sequence of characters, words or other elements usually symbolised with the dollar sign.

SYNTAX The name used to refer to sentence structure rules of programming language.

VALUE The numerical quantity of a data element, and is the number assigned to a variable.

VARIABLE A symbol whose numeric value can be changed at all times. It is used when writing programs.

V.D.U. (Visual Display Unit) A unit which is capable of showing data. They look like small televisions.



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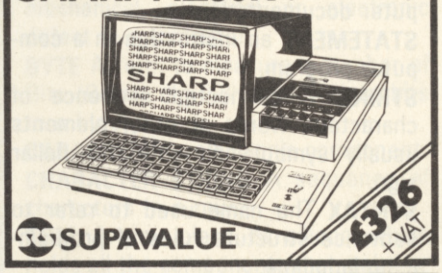

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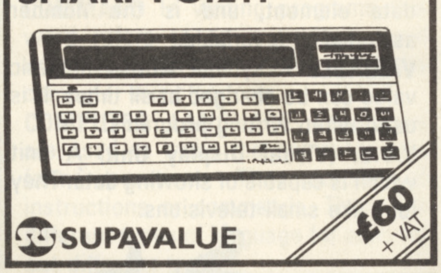

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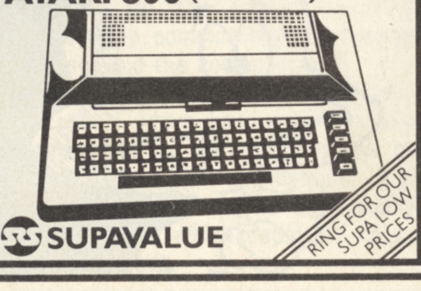
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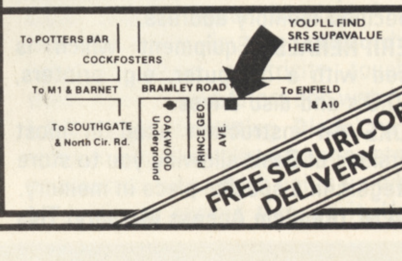

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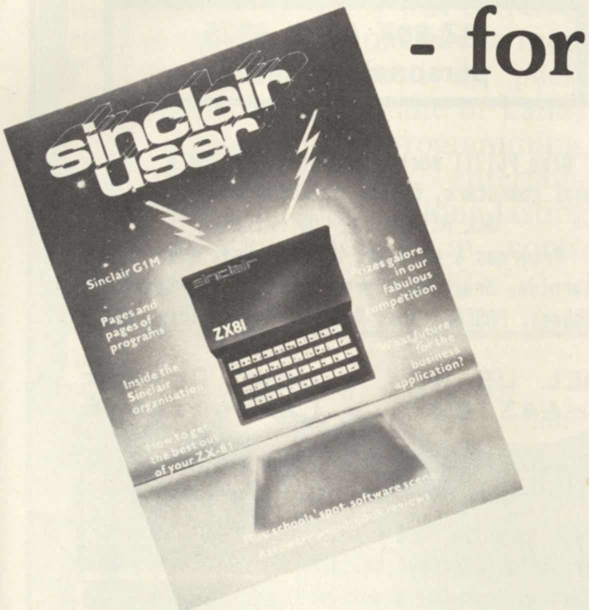
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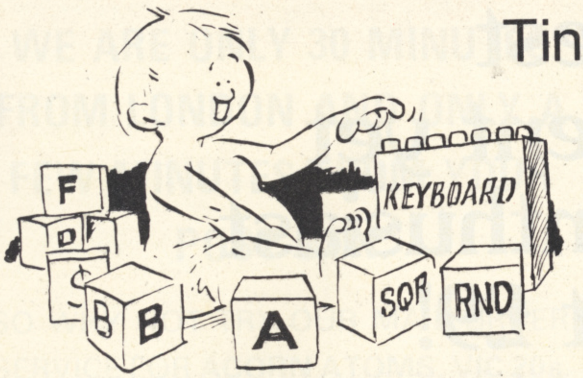

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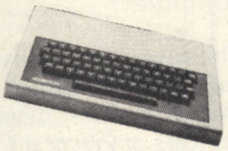

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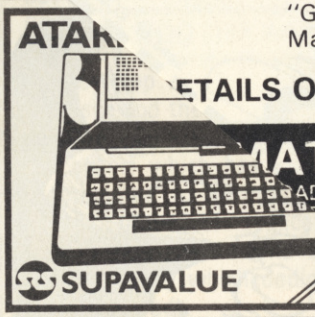

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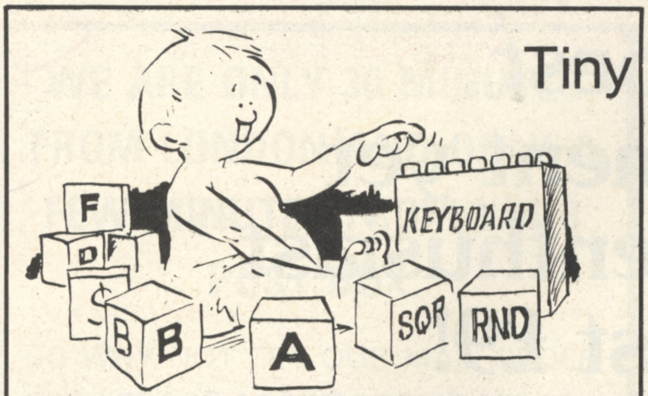

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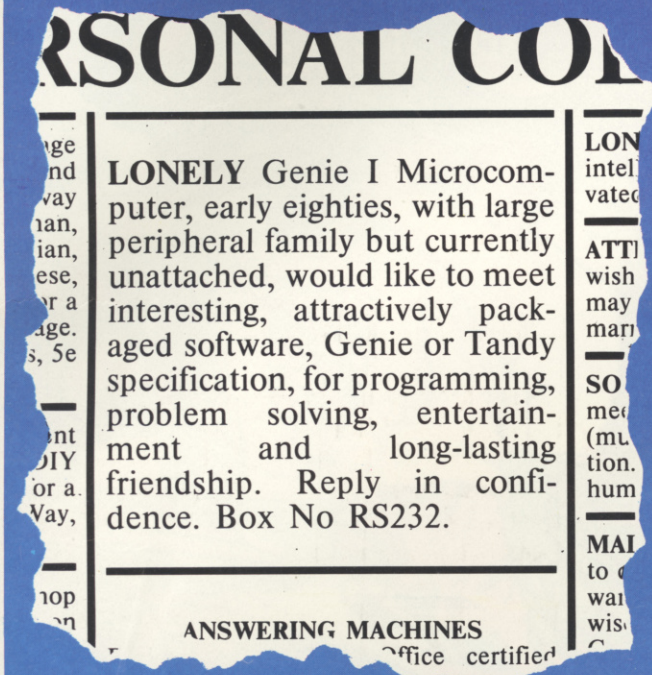

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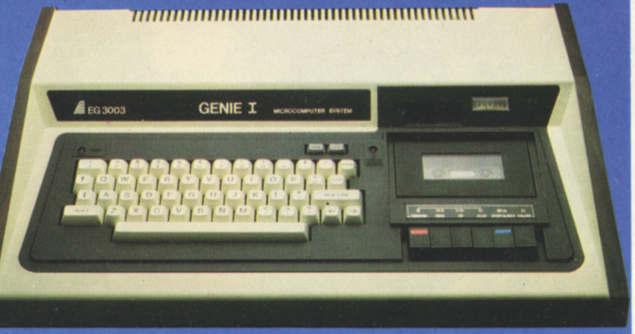

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